C007/035 Incoming
#3880
R

Sunnyside Cogeneration Associates

P.O. Box 10, East Carbon, Utah 84520 • (435) 888-4476 • Fax (435) 888-2538

July 25, 2011

Daron Haddock
Division of Oil Gas and Mining
1594 West North Temple, Suite 1210
Salt Lake City, UT 84116

RE: Permit Boundary Amendment – DOGM Task #3821
Sunnyside Cogeneration Associates, Sunnyside Refuse/Slurry, C007/035

Dear Mr. Haddock,

In response to the comments in your letter dated June 30, 2011, SCA is submitting the enclosed permit amendment which is principally associated with an adjustment to the permit area along the south and west boundaries. As you recall from the prior review, this amendment is intended to remove approximately 67.9 acres of undisturbed or previously reclaimed (Old Coarse Refuse Road) area.

As most of the drawings within the SCA Mining and Reclamation Plan identify the permit boundary, these have been updated and included as part of the amendment. SCA has also updated these drawings to reflect current topographic conditions obtained through an aerial survey in 2010.

We have enclosed three copies of the Permit Amendment (drawings, tables, text pages and appendices) for your review. If you have any questions, please feel free to call Rusty Netz or myself at (435) 888-4476.

Thank You,

Richard Carter
Agent For
Sunnyside Cogeneration Associates

c.c. Steve Gross
William Rossiter
Maggie Estrada
Paul Shepard
Rusty Netz
Plant File

File in:
☐ Confidential
☐ Shelf
☒ Expandable
Date Folder 072711 C/C0070035

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APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Sunnyside Cogeneration Associates
Mine: Sunnyside Refuse and Slurry **Permit Number:** C/007/035
Title: Permit Boundary Adjustment

Description, Include reason for application and timing required to implement:

Remove some undisturbed areas from permit area, update topographic contours and drawings and text to reflect the changes.

Instructions: If you answer yes to any of the first eight questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 67.90 Disturbed Area: 0.00 ☐ increase ☒ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?
☐ Yes ☒ No 24. Does the application include confidential information and is it clearly marked and separated in the plan?

Please attach three (3) review copies of the application. If the mine is on or adjacent to Forest Service land please submit four (4) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

RICHARD CARTER (Print Name) PLANT MGR. (Position) 7/25/11 (Date) _____ (Signature (Right-click above choose certify then have notary sign below))

Subscribed and sworn to before me this 25th day of July, 2011

Notary Public: _____, state of Utah.

My commission Expires: Dec 3rd 2011
Commission Number: 571930
Address: 1 Power plant Rd. P.O. Box 159
City: Sunnyside State: UT Zip: 84539

JODY HANSEN
Notary Public
State of Utah
My Comm. Expires Dec 3, 2011
1 Power Plant Rd P.O. Box 159
Sunnyside, UT 84539

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Form DOGM- C1 (Revised December 10, 2007)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Sunnyside Cogeneration Associates
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Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 1 - Pages 100-3 and 100-4
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 2 - Pages 200-2, 200-5 and 200-6
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 3 - Pages 300-1 thru 300-5, 300-12, 300-17, 300-18
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 4 - Pages 400-1 thru 400-9
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 5 - Pages 500-1 thru 500-4, 500-8 thru 500-19, 500-23
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 5 - Table 5-1
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 6 - Pages 600-1 thru 600-4, 600-8, 600-9 and table of contents
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 7 - Pages 700-1 thru 700-11, 700-16 thru 700-20 and table of contents
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 8 - Table 8-1 Bond Calculations
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 9 - Pages 900-1 thru 900-8, 900-12, 900-16, 900-17, 900-23
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 7 - Appendix 7-3D - Rail Cut Pond Hydrology
☐ Add	☒ Replace	☐ Remove	Permit Text Chapter 8 - Appendix 8-1D - Rail Cut Pond Hydrology - Permit Term Reclamation
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	Drawing 1-1, SCA Permit Area Legal Description
☐ Add	☒ Replace	☐ Remove	Drawing 2-1, Soil Identification Map
☐ Add	☒ Replace	☐ Remove	Drawing 3-1, Pre-Law, Post-Law and Future (Anticipated) Disturbed Areas
☐ Add	☒ Replace	☐ Remove	Drawing 3-2, Wildlife Resource Map
☐ Add	☒ Replace	☐ Remove	Drawing 3-3, Vegetation Resource Map
☐ Add	☒ Replace	☐ Remove	Drawing 4-2, Cultural Survey Areas and Site Locations
☐ Add	☒ Replace	☐ Remove	Drawing 4-3, Sensitivity Rankings
☐ Add	☒ Replace	☐ Remove	Drawing 5-1, Surface Facilities
☐ Add	☒ Replace	☐ Remove	Drawing 5-2, Road Classification Map
☐ Add	☒ Replace	☐ Remove	Drawing 5-2 C – Plan and Profiles Roads A & E
☐ Add	☒ Replace	☐ Remove	Drawing 5-2 D – Plan and Profiles Roads F, G & I
☐ Add	☒ Replace	☐ Remove	Drawing 5-2 G – Plan and Profiles Roads K, L & Q
☐ Add	☒ Replace	☐ Remove	Drawing 5-2 H – Plan and Profile Road B
☐ Add	☒ Replace	☐ Remove	Drawing 5-2 J – Plan and Profiles Roads M, N, P & R

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.

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☐ Add	☒ Replace	☐ Remove	Drawing 5-3, Access Road Drawing
☐ Add	☒ Replace	☐ Remove	Drawing 5-4, Slope Stability Criteria Map
☐ Add	☒ Replace	☐ Remove	Drawing 5-6, Existing Refuse Piles
☐ Add	☒ Replace	☐ Remove	Drawing 5-7, Previously-Mined Areas
☐ Add	☒ Replace	☐ Remove	Drawing 6-1, Borehole Sample Locations and Geologic Cross Section Locations
☐ Add	☒ Replace	☐ Remove	Drawing 7-1, Hydrologic Index Map
☐ Add	☒ Replace	☐ Remove	Drawing 7-1F, Borrow Area and Pasture Ponds (Upper Drainage)
☐ Add	☒ Replace	☐ Remove	Drawing 7-2, Surface and Groundwater Monitoring Locations
☐ Add	☒ Replace	☐ Remove	Drawing 7-7, Coarse Refuse Toe Sediment Pond Record Drawing
☐ Add	☒ Replace	☐ Remove	Drawing 7-8, Railcut Pond and Topsoil Pile Record Drawing
☐ Add	☒ Replace	☐ Remove	Drawing 7-10, Old Coarse Refuse Road Sediment Pond Record Drawing
☐ Add	☒ Replace	☐ Remove	Drawing 8-1, Permit Term Reclamation Plan - Phasing Plan
☐ Add	☒ Replace	☐ Remove	Drawing 8-2, Permit Term Reclamation Plan - Rough Grading Plan
☐ Add	☒ Replace	☐ Remove	Drawing 8-3, Permit Term Reclamation Plan - Drainage Areas and Diversions Plan
☐ Add	☒ Replace	☐ Remove	Drawing 8-4, Permit Term Reclamation Plan - Borrow Material Plan
☐ Add	☒ Replace	☐ Remove	Drawing 8-5, Permit Term Reclamation Plan - Seeding Plan
☐ Add	☒ Replace	☐ Remove	Drawing 9-1A, Excess Spoil Disposal Area #1 Design - Natural Ground
☐ Add	☒ Replace	☐ Remove	Drawing 9-1B, Excess Spoil Disposal Area #1 Design - Final Surface Configuration
☐ Add	☒ Replace	☐ Remove	Drawing 9-1C, Excess Spoil Disposal Area #1 Design - Cross-Sections
☐ Add	☒ Replace	☐ Remove	Drawing 9-1D, Excess Spoil Disposal Area #1 Design - Drainage Areas and Diversions
☐ Add	☒ Replace	☐ Remove	Drawing 9-4, Mine Sequencing - Years 2003-2023
☐ Add	☒ Replace	☐ Remove	Drawing 9-7, Areas of Permanent Mining Activity and Storage Areas
☐ Add	☒ Replace	☐ Remove	Drawing 10-3, Final Reclamation - Phasing Plan
☐ Add	☒ Replace	☐ Remove	Drawing 10-4, Final Reclamation - Grading Plan
☐ Add	☒ Replace	☐ Remove	Drawing 10-5, Final Reclamation - Drainage Areas and Diversions
☐ Add	☒ Replace	☐ Remove	Drawing 10-6, Final Reclamation - Borrow Material Plan
☐ Add	☒ Replace	☐ Remove	Drawing 10-7, Final Reclamation - Seeding Plan
☐ Add	☐ Replace	☐ Remove	

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☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☒ Remove	Drawing 5-2E - Road Plan and profile
☐ Add	☐ Replace	☒ Remove	Drawing 5-2F - Road Plan and profile
☐ Add	☐ Replace	☒ Remove	Drawing 7-1G - Pasture Pond Upper Drainage
☐ Add	☐ Replace	☒ Remove	Drawing 7-12 - East Slurry Cell Record Drawing
☐ Add	☒ Replace	☐ Remove	Drawing 6-2 - Hydrogeologic Map
☒ Add	☐ Replace	☐ Remove	Drawing 6-3 - Geologic Cross Section A-A', B-B', C-C'
☐ Add	☐ Replace	☒ Remove	Drawing 6-4 - Geologic Cross Section B-B'
☐ Add	☐ Replace	☒ Remove	Drawing 6-5 - Geologic Cross Section C-C'
☐ Add	☐ Replace	☒ Remove	Drawing 6-6 - Geologic Cross Section C-C'
☐ Add	☐ Replace	☒ Remove	Drawing 7-4 - Clear Water Sediment Pond Drawing
☐ Add	☐ Replace	☒ Remove	Drawing 7-12 - East Slurry Cell Record Drawing
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
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112.600 Contiguous Property

The name and address of each owner of record of all property (surface and subsurface) contiguous to any part of the proposed permit area:

U.S. Department of the Interior
Bureau of Land Management
Utah State Offices
324 South State Street
Salt Lake City, UT 84101

Utah Reverse Exchange LLC
28311 North Main St Ste B-200
Daphne, Alabama 36526

Headwaters Incorporated
10653 South Riverfront Pkwy Ste 300
South Jordan UT 84095

Historical Properties, Inc.
207 Montgomery
Suite 215
Montgomery, AL 36104

East Carbon City
East Main St.
East Carbon, UT 84520

Covol Technologies, INC.
11778 South Election Rd.
Suite 210
Draper, Utah 84020

Sunnyside Properties, L.L.C.
One Power Plant Road
PO Box 139
Sunnyside, UT 84539

Water Canyon Holdings, LLC
6301 Monroe Street
Daphne AL 36526

Sunnyside Cogeneration Associates
PO Box 159
Sunnyside UT 84539

112.700 MSHA Numbers

The MSHA numbers for all mine-associated structures that require MSHA approval:

Coarse Refuse Pile	1211-UT-09-02093-01
Excess Spoil Disposal Area #1	1211-UT-09-02093-04
Excess Spoil Disposal Area #2	1211-UT-09-02093-05

112.800 Applicants Interest in Contiguous Lands

Applicant holds a lease contiguous to the SCA Permit Area; specifically, SCA holds a lease on the 72.5 acres (directly north of the SCA Permit Area) upon which the cogeneration power plant is located. The area covered by SCA's leasehold interest is shown as "Lease Area" on Plate 1-1. In addition, SCA leases land from the City of East Carbon to the west of the Permit Area.

SCA also owns property adjacent to the current permit area along the south and west sides.

220 ENVIRONMENTAL DESCRIPTION

221 Prime Farmland Investigation and Determination

The Soil Conservation Service (SCS) study of the SCA Permit Area, shows that no soil mapping units or areas have been designated as Prime Farmland. Figure 2-1 is a letter from Ferris P. Allgood, State Soil Scientist, stating that the soils in the Permit Area do not meet the criteria of either Prime or Important Farmlands. Additionally, Figure 2-1 includes an AD-1006, Farmland Conversion Impact Rating for the SCA Permit Area.

222 Soil Survey Information

The Soil Conservation Service's Survey of Carbon Area, Utah (Issued June 1988) was used for the soil survey on the SCA Permit Area and was the primary source of soils information. Plate 2-1 contains soil identifications for the SCA Permit Area and surrounding properties based on the SCS's soil survey. Plate 2-1 also identifies the locations where soil samples have been taken and where the results from the analysis can be found.

Within the SCA Permit Area, five soil mapping units and three soil series were identified. The soil mapping units include:

Soil Mapping Unit Name	Number
Badland-Rubbleland-rock outcrop complex	3
Gerst-Strych-Badland complex, 3 to 50 percent slopes	36
Strych very stony loam, 3 to 15 percent slopes	113
Strych very stony loam, dry, 3 to 30 percent slopes	114
Travessilla-Rock outcrop-Gerst complex	121

The soil mapping unit names and numbers are taken from the Soil Survey of Carbon Area, Utah. Detailed descriptions of the soil mapping units within the SCA Permit Area are presented in Appendix 2-1. Detailed descriptions of the soil series units within the SCA Permit Area are presented in Appendix 2-2.

Plate 5-1 ~~(A-E)~~, Surface Facilities, outlines each of the topsoil and borrow areas. Plates 3-1, ~~3-1A, 3-1B, 3-1C, 3-1D, and 3-1E~~ shows the pre-law, post-law and future (anticipated) disturbed areas for the SCA Permit Area.

An "Order One" soil survey was conducted by the SCS (see Appendix 2-8) and an additional soil testing program was conducted by ACZ (see Appendix 2-9) on the following areas:

Industrial Borrow Areas One through Three
Reclamation Borrow Area
Proposed Access Road (shown in Plate 5-3)
Material placed on Coarse Refuse Lifts (Sub-Area 1)
Sub-Area 3

Most sodium absorption ratio values (SAR) are rated good (<5). Four samples had SAR values between 5 and 5.6. Three other values were between 8.2 and 8.5. Two values were 10.4 and 11.0 respectively. SAR should not be considered limiting for this project.

Rock fragment content (percent coarse fragments) varies within any soil profile and across the study area. Review of the Strych coarse fragment data suggests the only limiting feature is the variable presence of boulders in the upper few feet across the study area. These can be segregated during salvage as is the current practice at SCA today. The boulders can be used as riprap for other purposes. Perhaps 5% of the overall volume of salvageable soil is boulders."

230 OPERATION PLAN

231 General Requirements

Generally, the land within the SCA Permit Area has been disturbed. Plates 3-1, ~~3-1A, 3-1B, 3-1C, 3-1D, and 3-1E~~ outlines the pre- and post-law disturbed areas. Most of the major disturbed areas were created prior to the 1977 Act and therefore little topsoil has been saved. The few topsoil stockpile areas are shown in Plate 5-1, Surface Facilities.

It is anticipated that only a small portion of additional land will be disturbed during the mining activities. These lands include the borrow areas. The following potential impacts to soil resources could result from the mining activities: removal of vegetation, disturbance and exposure of the soil, mixing of soil horizons, loss of topsoil productivity, increase in the susceptibility of the soil to subsequent wind and water erosion, and loss of the soil resource.

Mitigation measures for soils during mining are closely tied to mitigation measures associated with controlling erosion caused by water, wind, loss of vegetation, and construction procedures associated with stockpiling topsoil, and reclamation. The objective of implementing the measures outlined in the following sections is to reduce soil erosion and compaction, enhance revegetation of disturbed areas, and provide for long-term conservation of the soil resource within the SCA Permit Area. All potential impacts to soils identified above will be avoided or reduced to levels of nonsignificance.

Additional details on activities that will occur during mining are included in Chapter Nine.

Methods for Removing and Storing Topsoil, Subsoil, and Other Materials

Handling of topsoil during mining operations will involve removal of vegetation, topsoil stripping, stockpiling, and replacement of the topsoil onto the areas to be reclaimed. Trees and large shrubs will be removed prior to topsoil removal. Small shrubs, grasses, and forbs will be collected with the topsoil material since these materials increase both the available organic matter in the soil and the available seed stock.

Prior to any surface disturbance in previously undisturbed areas or reclaimed areas topsoil will be removed. Topsoil removal and handling will be accomplished with front-end loaders, and trucks. Topsoil storage piles will be adjacent to existing topsoil piles (shown in Plate 5-1) or other areas adjacent

to the disturbance.

New topsoil storage piles will be contoured to minimize soil loss and seeded with a seed mixture consisting of rapidly establishing grasses and forbs (see Chapter Nine, Section 9.9.2 for interim seeding schedule). Fertilizer will not be required for stockpiles. A small berm will be constructed at the base of the new topsoil piles as interim containment of soil that may be displaced while vegetation becomes established. Calculations to determine the size of the berm are found in Appendix 7-7. Activity around the stockpiles will be minimized so that damage to the piles will be reduced.

Suitability of Topsoil Substitutes

Several borrow areas have been identified for use in future reclamation (Plate 5-1). The quantity of available borrow material that has been identified, is outlined in Section 224.

Areas which will receive borrow area soil and the surface area upon which the borrow material will be utilized as a plant growth medium is shown in Plates 10~~-1~~6.

In 1985 a soils investigation was conducted on the Reclamation Borrow Area to locate additional suitable borrow material (Appendix 2-4) for reclamation activities. This investigation included a soil survey and soil sampling using test pits. Four test pits were dug and were identified as ST1, ST2, ST3 and ST4. The location of these pits is shown in Plate 2-1. A determination was made on the soil physical and chemical properties, its susceptibility to erosion, suitability for topsoil, and the soils feasibility for reclamation. This investigation showed that the soil in the Reclamation Borrow Area is rated fair for use as borrow material and should be suitable for vegetation establishment.

Results of the studies conducted in 1985 on the three Industrial Borrow Areas are included in Appendix 2-5. The information includes test methods, laboratory procedures, and sampling results. Borrow from each of these areas was found to be suitable as a substitute material for topsoil.

Revegetation test plots have been approved by DOGM and will evaluate revegetation success under several soil depths, amendments, and seeding regimes. Additional analysis of the revegetation test plots is currently proceeding. The results of these tests, should provide information concerning the most appropriate reclamation techniques and procedures to ensure revegetation success. The design of the revegetation test plot is included in Appendix 2-6. A report from a 1982 study on this test plot is included in Appendix 2-3.

Testing Plan for Topsoil Handling and Reclamation

Details on testing for topsoil and borrow material handling and reclamation can be found in Chapter Nine, Mining Plan, Sections 9.8, 9.9 and 9.11, as well as Chapter Ten, Reclamation Plan, Sections 10.7 through 10.9.

232 Topsoil and Subsoil Removal

Handling of topsoil during mining operations will involve removal of vegetation, topsoil stripping, stockpiling, and replacement of the topsoil onto the areas to be reclaimed. Trees and large shrubs will be removed prior to topsoil removal. Small shrubs, grasses, and forbs will be collected with the topsoil

CHAPTER THREE
300 BIOLOGY

310 INTRODUCTION

311 thru 313 General Requirements

The refuse disposal area previously created by the Sunnyside Coal Company (SCC) has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternative fuels as sources of waste fuel for the facility. SCA's fueling plan includes excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials as discussed in Chapter Nine, will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

The focus of this chapter is the biological related topics within the SCA Permit Area. These include: vegetation and wildlife resources; vegetation and wildlife affected or potentially affected by the excavation of coal mine waste and other cogeneration project activities; and mitigation/management plans.

The vegetative, fish, and wildlife resources, potential impacts to vegetation, fish, and wildlife resources and proposed reclamation designed to restore or enhance vegetative, fish, and wildlife resources within the SCA Permit Area and adjacent areas are included in the appropriate sections. Appropriate maps, plans, and cross sections are referenced accordingly.

It should be noted that SCA has compiled and relied on data and maps from previous approved permits ~~applications~~ for the SCC mines. The Biology section has been appended to reflect the SCA Sunnyside Permit Area. In this Permit Application where the "permit area" is referred to, the SCA Sunnyside Permit Area is to be assumed unless the larger overall area for the SCC is specifically referred to in the text as the "original SCC permit area."

320 ENVIRONMENTAL DESCRIPTION

321 Vegetation Information

Vegetation Communities

A one-day field reconnaissance trip to the site was conducted on the SCA permit area on December 17, 1992. The vegetation of the SCA Permit Area has been mapped and the following is a list of communities that have been disturbed:

1. Pinyon-Juniper/Grass;
2. Atriplex/Grass
3. Sagebrush/Grass

Plate 3-3, Vegetation Resource Map, identifies the vegetation types within and surrounding the SCA Permit Boundary. Plate 3-3 also delineates the two vegetative reference areas. Baseline production data is not critical until the time of comparison with the revegetated areas and does not need to meet statistical adequacy until that time. Nonetheless, Appendix 3-3 includes baseline information from the Reference Areas. A statement from the SCS on the condition and production of vegetation within and adjacent to the SCA Permit Area, as well as the reference areas, is given in Figure 3-4.

General Site Description

The SCA Permit Area is located to the southeast of East Carbon City. The SCA Permit Area is approximately ~~320~~ 250 acres and contains a number of structures that were previously used for desilting of waters and slurry mixtures associated with the Sunnyside coal mine. The SCA Permit Area also previously served as a refuse site for coal mine waste materials from the Sunnyside coal mine. The area is relatively flat near the majority of these diversion structures (approximately 5% cross slope). Near the south and west boundaries of the SCA Permit Area the slopes reach approximately 20%. The ground elevations range from approximately 6120 feet to 6600 feet. Coal mines have been in operation in the area since the 1890's. The surrounding area has been extensively grazed by sheep, goats, horses and cattle (personal communications from George Cook, Soil Conservation Service).

Vegetation Types

The original native vegetation within the SCA Permit Area includes Pinyon-Juniper/Grass, Sagebrush/Grass and Atriplex/Grass habitat. Additionally, a small area containing hydrophytic vegetation is located at the base of the coarse refuse pile. The total disturbed vegetation within the SCA Permit Area is estimated at approximately ~~57~~80% of the SCA Permit Area. The pre- and post-law disturbed areas are shown on Plate 3-1. SCA claims to be exempt from the Act and final reclamation for the pre-law disturbed areas. General descriptions of vegetation types within the SCA Permit Area and surrounding areas are given below, and a detailed discussion of the riparian and hydrophytic vegetation types is included in Appendix 3-1, Riparian Vegetation Discussion.

Vegetative Community Descriptions

Pinyon-Juniper Community

Various Pinyon-Juniper communities dominate the undisturbed areas near the eastern and southern borders of the permit area. These communities exist on level to moderately sloped hillsides and on various exposures. The Pinyon-Juniper communities were characteristically rather sparsely vegetated with understory cover. This was especially true for grasses and forb species.

Dominant woody species observed in these communities were: Utah juniper (Juniperus osteosperma), pinyon pine (Pinus edulis), and broom snakeweed (Gutierrezia sarothrae). Snow coverage and the time of year observed prevented detailed species identifications for forbs and grasses. One could assume, however, that Fendler euphorbia (Euphorbia fenderli), aster (Aster spp.) and globemallow (Sphaeralcea coccinea) would be commonly observed. Grass species common to the area include: Salina wildrye (Elymus salinus), slender wheatgrass (Elymus trachycaulus) and galleta (Hilaria jamesii).

Sagebrush/Grass Community

When the slopes become gentler near their base, the alluvial soils become deeper and support Sagebrush/Grass communities. These communities were dominated by big sagebrush (Artemisia tridentata), broom snakeweed, and rubber rabbitbrush (Chrysothamnus nauseosus). Grass species were: Indian ricegrass (Stipa hymenoides), bluebunch wheatgrass (Elymus spicatus) and Salina wildrye. Forb cover was relatively small, but included species i.e. rockcress (Arabis spp.), cryptantha (Cryptantha humilis) and Fremont goosefoot (Chenopodium fremontii).

Atriplex/Grass

Some of the steeper slopes principally located on the southern exposures of the slurry cells were dominated by Atriplex/Grass communities. These communities exist on dry, saline, and the more heavy-textured soils within the permit area. Dominate shrub species were: shadscale (Atriplex confertifolia), corymb buckwheat and (Eriogonum corymbosum). Common grass species were galleta (Hilaria jamesii).

Disturbed Communities

Much of the permit area is comprised of disturbed plant communities. Mining and coal cleaning activities previously disturbed these communities. Prior to disturbance, these communities were most likely the communities described above. The disturbed communities support some native woody species and perennial forbs, but also a host of weedy species such as: thistle (Circium spp.), bindweed (Convolvulus arvense), gum weed (Grindelia squarrosa), halogeton (Halogeton glomeratus), wild lettuce (Lactuca serriola), stickseed (Lappula redowski) and African mustard (Malcomia africa).

Hydrophytic Vegetation

The hydrophytic community contains cattails and bulrush vegetation types. Cattails are tall herbaceous semiaquatic perennials from creeping, thick rhizomes. Their flowers are densely crowded in terminal, cylindrical, spikelike inflorescences. The stems are erect and simple with long, linear flat leaves. Bulrushes are perennial commonly 10-30 dm tall. The leaves are on the lower 1/4 of the culms. They are found on the margins of ponds and lakes, marshes and swamps, seeps, springs, washes, and flood plains at 1097 to 2200 m in all Utah counties.

Snow coverage and the time of year observed prevented detailed species identifications for forbs and grasses. Although, a detailed species list was obtained in July, 1993 which is included in Appendix 3-1. This appendix includes a discussion of the hydrophytic vegetation within the SCA Permit Area.

Protection of Riparian Areas

The area near the base of the existing Coarse Refuse Pile contains hydrophytic vegetation. Historic aerial photos (1952 and others) show vegetation at the toe of the wash which appears to indicate that natural water sources existed prior to the mining operations associated with construction of slurry de-watering systems. Many people believe that operation of the West Slurry Cell and possibly also the East Slurry Cell caused an increase in the flow of water at the "Coarse Refuse Seep." However, the seep has not been identified as a point source discharge. The flows are believed to have had water quality similar to the monitoring data shown in Appendices 7-4 and 7-6 for the past few decades. The vegetation in the area of the seep and along its water course is lush. Consequently, the water quality cannot be viewed as harmful to the vegetative species adapted to the immediate area. Toxicity to wildlife would be difficult to determine, however the seep area is utilized by wildlife without any apparent adverse effects.

The 1994 cessation of operations at the Sunnyside Coal Mine eliminated disposal of slurry materials in the SCA permit area. A reduction of flow at the seep appears evident in the monitoring data presented in Appendix 7-4. As long as operations at SCC do not resume, future flows in the seep area are not expected to be associated with the slurry cells. The Division has determined that this reduction in surface water flow is not considered to be a direct result from mining and reclamation operations for the permittee (SCA). If the vegetation adapts to conditions with reduced water availability, it would not be considered a negative impact requiring mitigation on the part of SCA.

SCA will take measures to avoid disturbing the natural environment in the seep area by keeping equipment within the existing disturbed area as identified on Plates 3-1. The general area of the seep is not considered disturbed area with the exception of the three individual weir locations as shown on Plate 7-1C. SCA has placed straw bales in the flow, in accordance with the description provided in Section 728.310 of Chapter 7, to inhibit migration of sediments and enhance particle filtration. SCA does not anticipate removing soils from the entire area and attempt to recreate a new wetland area since this would only disturb a large area of otherwise stable vegetation.

Productivity

Productivity or biomass of the plant communities was not estimated by quantitative methods, but they probably ranged from 400 to 1,200 lbs. per acre. The plant communities should be samples in 1993 or estimated by the USDA Soil Conservation Service for a more precise estimate of productivity. A recent overall productivity assessment is included as Figure 3-5.

322 Fish and Wildlife Information

The following sections include fish and wildlife resource information for the SCA Permit Area and adjacent areas according to regulations set forth by DOGM.

Fish and Wildlife Descriptions

DOGM, along with federal and state agencies, are responsible for determining the level of detail that is required for the protection of fish and wildlife in the SCA Permit Area and adjacent areas. This information is included under regulation R645-301-333. The following paragraphs describe the fish and wildlife habitats that are required under this regulation and its subcategories.

The SCA Permit Area is comprised of approximately 250~~320~~ acres. The much larger area that was surveyed for the original SCC permit encompassed a portion of the West Tavaputs Plateau in Carbon County, Utah. Generally speaking, cold desert (upper Sonoran life zone), submontane (Transition life zone) and montane (Canadian life zone) ecological associations encompass the West Tavaputs Plateau. These life zones could be inhabited on occasion and during different seasons of the year by about 363 species of vertebrate wildlife--20 fish species, 5 amphibian species, 14 reptile species, 244 bird species and 80 mammal species.

Because of the amount of past disturbance, the SCA Permit Area provides little habitat for the majority of the species that frequent the area.

Threatened and Endangered Species

SCA contacted the U.S. Fish and Wildlife Service in 1992 to request a list of Threatened and Endangered Species which may occur in the SCA Permit Area. A response memo is included in Figure 3-2. The OSM has determined that the work within the SCA Permit Area does not meet the definition of a "Federal Action," therefore consultation with the U.S. Fish and Wildlife Services is not required (Figure 3-3).

In 1992, the United States Fish and Wildlife (USFWS) stated that one federally endangered species and one candidate species may occur within the proposed project area, based on range, habitat requirements, and historical occurrence. The endangered species that may have occurred was the bald eagle and the candidate species is the Canyon sweet-vetch, which currently has no legal protection. A Biological Assessment (BA), included in Figure 3-4, was completed by Pioneer Environmental in January 1993 to determine if impacts to these species would occur from the project. Additionally, the BA took other sensitive raptor species into consideration. The BA concluded that "the implementation of SCA's proposed cogeneration project would have no effect on migrant wintering bald eagles" and "no impacts to the canyon sweet-vetch are to be expected." The bald eagle is no longer listed as an endangered species (it is now listed as threatened), however the general information included in Figure 3-4 can still be a helpful resource.

Additionally, the peregrine falcon, a listed endangered species proposed for delisting, has reportedly been found in the Book Cliffs area a few miles from the permit area. Paul Baker (DOGM) has confirmed sitings. Discussions have been held with the Division concerning whether or not raptor surveys would be needed. Both the permittee and the Division have agreed that, considering the location of the permit site and the ongoing nature of SCA's activities, it is highly unlikely that the mining and reclamation activities of SCA would negatively affect raptor nesting sites. Therefore, raptor studies would have little value.

Additionally, because the project area is within the watershed of the Colorado River, which contains four listed species of endangered fish, the USFWS requires that the impacts due to water depletion from the proposed project must be determined. These fish include the Humpback chub, the Bonytail chub, the Colorado squawfish, and the Razorback sucker. In discussions with Susan Lineer with the USFWS it has been determined that there would be no effect to the water resources from the SCA activities, and therefore, no effect to the endangered fish. The only impact to the water resources within the SCA Permit Area include:

1. Watering roadways to control fugitive dust, and
2. Evaporation from the sediment ponds.

Detailed discussion of the Probable Hydrologic Consequences is included in R645-301-728.

biogeographic area that surrounds the SCA Permit Area. All of these species are of high interest due to their value in the fur market.

The substantial valued use area for short-tailed and long-tailed weasels, mink, river otter, muskrat and raccoons is the riparian habitat. Weasels, which are inhabitants of the biogeographic area that surrounds the SCA Permit Area, do make some use of other habitats that are proximal to riparian zones. Muskrats and raccoons are restricted to riparian habitats of the cold desert and submontane ecological association; thus, they are not found within the SCA Permit Area. The long-tailed weasel can be found from the cold desert up into the montane (Canadian and Hudsonian life zones) ecological associations. The short-tailed weasel, river otter and mink populations extend their use from the submontane into the montane ecological association. It is important to note that the weasel is restricted to the Canadian life zone. The river otter and mink utilize the Canadian and Hudsonian life zones. The river otter is not known to inhabit the environs surrounding the SCA Permit Area, but mink are present.

The substantial valued use area for marten and wolverine is the montane ecological association. The marten does not utilize the alpine life zone but the wolverine can be found in the environs surrounding the SCA Permit Area.

A potential range of the ferret is the pediment slopes southwest of the original SCC permit area (Hinkley, 1970, Scott et. al., 1977, both cited in USDI, 1979). Two whitetailed prairie dog towns are known to occur within or nearby the SCA Permit Area, section 6 (R14E, T15S) in the southwest corner (Plate 3-2). The town on the southwest-southeast quarter section boundary is in an abandoned cemetery and contains ten active burrows. No ferrets or ferret signs have been observed, but only reconnaissance surveys have been conducted. The nearest probable ferret sighting was about two miles northwest of Woodside on Highway 6, about eighteen miles south of the SCA Permit Area (Scott, et. al., 1977, cited in USDI, 1979). The date of this sighting is not known.

An unconfirmed sighting of a black-footed ferret is documented in Carbon County, eastern 1/2 section 10, T15S, R13E, according to Phil Garcia, conservation office, Utah Division of Wildlife Resources on 02-10-80.

The **black-footed ferret** is on the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 1711). The black-footed ferret is a species primarily dependent upon prairie dogs as a prey source. Currently, the ferret's relative abundance is so low that the animal is endangered with extinction. Utah lies on the western edge of the black-footed ferret's historic range. The substantial value use area for this species is restricted to prairie dog colonies. Prairie dog colonies are found within a multitude of wildlife habitats within the cold desert, submontane and montane (Canadian life zone) ecological associations. There is a strong association of ferrets with prairie dog towns because the prairie dog is the primary prey species and its burrows are used as ferret dens.

The substantial valued use area for **badger and skunks** span all wildlife habitats other than dense forests in the cold desert, submontane and montane (Canadian life zone) ecological associations. Skunks and badgers are dependent upon a suitable prey source.

A crucial period for maintenance of all furbearers, raccoons and muskrat populations is when they have young in a nest, den or lodge. Such sites are critical for reproductive success.

The **mule deer** herd unit 27B - Range Creek was studied for the original SCC permit area. Herd unit 27B occupies the east half of Carbon County, part of the north side of Emery County, and the south side of Duchesne County for a total land area of 1,169,408 acres (Utah State Department of Fish and Game, 1967). Whitmore Canyon is on the south side of the unit. The herd does not have summer or winter

insertion into the permit, SCA has submitted the report as Appendix 3-6 for DOGM reference. Due to the time of year in which the site visit occurred, vegetation analysis was not possible. However, the report does summarize the history and purpose of this test plot as well as convey optimism that the test plots may be beneficial in predicting the reclamation potential even though past monitoring was not detailed enough to clearly meet success standards.

Other areas where revegetation efforts have been performed will also be compared when determining successful revegetation methods and treatments. SCA performed reclamation of the Old Coarse Refuse Road during 1994 in which refuse material was removed off of the steep sloped and placed into the roadway cut. Four feet of borrow material was placed over the refuse. The outer slope was covered with less than four feet. ~~A qualitative assessment of the revegetation during the first year following seeding appeared very promising. Continued~~ This reclamation area received final bond release in 2011. The success of the revegetation on this site ~~will~~ provides additional demonstration that the standards for revegetation success can be met.

Additional monitoring of revegetation success will continue to be reported as specified in Chapter Nine.

REFERENCE AREAS

Two reference areas that were initially chosen represent the native plant communities of the permit area. These reference areas (shown on Plate 3-1) were surveyed in July, 1993 and a complete report of the findings is included in Appendix 3-3. ~~and t~~The results of the survey are to be used as a standard for revegetation success at the time of final reclamation ~~in July, 1993 and a complete report of the findings is included in Appendix 3-3.~~

Pinyon/Juniper/Sagebrush Reference Area

A big sagebrush/grass community with scattered pinyon pine and juniper trees was chosen as a standard of success for both the Pinyon-Juniper and the Sagebrush/Grass communities described above. Because the area's slopes gradually decrease to more of a valley or alluvial fan situation, it is believed that the majority of the disturbance from the mining activities was on a plant community similar to the one chosen for a reference area. However, there were probably isolated patches of other plant communities in the area, i.e., pinyon-juniper or rabbitbrush. It is for this reason that the Pinyon/Juniper/Sagebrush community was chosen as a reference area to represent these communities. The species mixture compiled for revegetation will include species that can be adapted to both the Pinyon-Juniper and Sagebrush/Grass communities in the area. Presumably, the species in the mixture that are more adapted to each exposure, soil type, slope, moisture relationship and so on will become established to a degree to meet final revegetating standard set by the reference area. The original seed mixture recommended for this area is included in Appendix 3-3. Consultation with the DOGM Biologist resulted in modifications to the seed mix and the current approved mix is included in Chapter 10.

If, in fact, another area becomes obviously more suitable at the time of sampling, the Division of Oil, Gas & Mining will be contacted for their biologist's opinion and approval.

Atriplex/Grass Reference Area

Another reference area was chosen to represent the steeper slopes common around the disturbance areas. This area is located on slopes at the west end of the SCA permit area. This reference area will be used as a standard of success for final revegetation for similar areas that have been previously disturbed (and many continue to be disturbed). The areas to be reseeded will be areas with similar soil types, exposures,

slopes and other environmental variables. The original seed mixture recommended to be used in these areas is included in Appendix 3-3. Consultation with the DOGM Biologist resulted in modifications to the seed mix and the current approved mix is included in Chapter 10.

A general description of this community type can be found in Section R645-301-321.100.

VEGETATION SAMPLING

As previously mentioned, quantitative sampling for these communities was accomplished during July 1993. The vegetation was sampled in an attempt to adequately describe the area proposed for future disturbance and/or reference area to be used for future standards. Sampling methods used were consistent with those accepted by the State of Utah, Division of Oil, Gas & Mining. A brief summary of the methods used are described below.

Sampling will also be conducted similarly on the revegetated area of the permit area for year-to-year monitoring and for final comparisons with the reference areas. Appropriate and approved statistical comparisons will be implemented to assure a standard of 90% of the success standard as required in R645-356.120 of the State regulations.

Diversity will be determined by ranking all species within the community by relative cover. The ranking determines the relative importance of each species. The number of species contributing greater than five percent of the relative importance in the reference area data designates the number of species, the life forms, and seasonality of the species to be established in the reclaimed area. No one species will make up greater than 50% of the importance value.

$$\text{Relative Cover (\%)} = \frac{\text{Cover (\%) for Species}}{\text{Total Vegetation Cover (\%)}}$$

$$\text{Relative Cover} = \text{Relative Importance}$$

COVER AND COMPOSITION

Cover and composition were made using meter square quadrants. Line transects were arbitrarily placed within each area. Along these transects, points were placed at regular intervals. At each interval, random numbers were then chosen to place the quadrants perpendicularly on each side of the transect line.

Understory cover estimates were made using ocular methods. Species composition and relative frequencies were also assessed from the quadrants. Additional information recorded on data sheets is estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes.

Woody Species Density

Density of woody plant species was recorded using the point quarter distance methods (from Cottom and Curtis 1956) in the sample areas. In the point quarter method, random points was placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance is equal to the square root of the mean area per individual.

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410 INTRODUCTION

The refuse disposal area, previously created by the Sunnyside Coal Company (SCC), has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternate fuels as sources of waste fuel for the facility. SCA's fueling plan will require excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials as discussed in Chapter Nine, will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

Currently, there are activities that occur outside the Sunnyside Cogeneration Associates Permit Boundary that have significant bearing on the operations of the SCA Cogeneration facility and the SCA Permit Area. These activities occur in conjunction with the SCA permit site.

In order for SCA to acquire the quality and quantity of fuel for the cogeneration facility, coarse or fine refuse materials maybe accepted from off-site facilities as needed. The refuse is stockpiled in designated areas within the SCA permit site then mixed with existing refuse on the SCA permit site and transported to the cogeneration facility. These operations; acceptance of refuse from off-site facilities and the transporting of coarse refuse to the cogeneration facility, require access roads that extend beyond the limits of the SCA permit boundary.

In addition to the access roads mentioned above, there are access roads to the south of the SCA permit boundary that are utilized for the purposes of the SCA operations. These roads are utilized to access areas of the SCA permit site that are inaccessible from the north side of the permit area. They are used by authorized contractors of SCA for the purposes of such activities as: water quality monitoring, periodic inspections, and site maintenance as needed.

Activities that occur outside the SCA Permit Area also include watersheds outside the permit area that drain into contained areas within the permit area. Chapter Seven of the Permit outlines these watersheds and the areas to which they drain. Also included are detailed maps and calculations showing the amount of water from each watershed and the capacity of the drainages and ponds that were constructed to contain them. In some instances, a drainage commencing within the SCA Permit Area may extend beyond the limits of the SCA permit boundary. An example of this is the outlet of the Pasture Sediment Pond. In such a case, SCA commits to maintaining this drainage and providing the necessary information to the Division to show its adequacy to handle the required storm event. In the event that this occurs elsewhere within the permit area, SCA will handle each instance on a case-by-case basis and notify the DOGM of any proposed changes to the Permit.

It should be noted that the SCA operations encompass a number of entities that do not necessarily lie or operate within the permitted area. The activities that occur outside of the permitted area are done so in a controlled manner, under permits from other agencies, and have been incorporated into the entire design and plan of the SCA Cogeneration facility. SCA understands the implications of utilizing entities outside of the permitted area. SCA commits to maintaining the applicable Permit Areas in accordance with DOGM requirements.

This chapter includes descriptions of the premining and proposed postmining land use(s) in accordance with the applicable regulations. It should be noted that SCA has compiled and relied on data and maps from previously approved permits for the SCC mines. In this Permit Application where the "permit area" is referred to, the SCA Sunnyside Permit Area is to be assumed unless the larger overall area for the SCC mines is specifically referred to in the text as the "original SCC permit area."

411 ENVIRONMENTAL DESCRIPTION

Premining Land-Use Information

The land within the SCA Permit Area has been confined to fish and wildlife habitats. Historically, the land within the SCA Permit Area has not been used for croplands because of the mountainous terrain, steep slopes, and rocky surfaces. Farming in the surrounding area is limited to small areas on canyon bottoms. About four acres of alfalfa, irrigated with mine water, has been farmed in the past adjacent to the SCA Permit Area. Plate 1-1 outlines the boundaries of ownership of the areas within and adjacent to the SCA Permit Area.

Premining land-use information is further outlined in the following sections. The descriptions include cultural and historic resources information, complete narratives of the land-use capabilities, and descriptions of the existing land uses and land-use classifications under local law as required by regulations R645-301-411.120 through R645-301-411.140.

Maps and Narratives Describing Existing Land Uses

The information on land status and land use has been obtained primarily from SCC's records and internal sources as well as from Carbon County records. Currently the site is mostly disturbed. The Disturbed Area Map, Plate 3-1, outlines pre and post-law disturbed areas within the SCA Permit Area.

Information on regional land use and socioeconomic considerations has been derived impart from the "Final Environment Statement, Development of Coal Resources in Central Utah" by the U.S. Geological

Survey (1978) and from the Utah Office of Planning and Budget's Report "1990 Statistical Abstract of Utah" which covers quite fully the subject matter for the area of interest. It is assumed that the socioeconomic conditions of the area have not changed dramatically over the past decade and that the SCA activities will have much of the same impact as the SCC mines to the surrounding communities.

Land Use Narrative

Regionally, about 76% of the surface lands are Federal. Only a small part of the total acreage is irrigated farmland. Prime farmland has not been identified within the SCA Permit Area. Figure 2-1 is a current letter from the Soil Conservation Service stating that there is no prime or important farmland within or adjacent to the SCA Permit Area. The SCA Permit Area land use is dominated by a refuse pile. It is estimated that approximately 8057% of the SCA Permit Area has been disturbed by mining operations. The disturbed areas contained mostly Pinyon-Juniper/Grass and Atriplex/Grass type vegetation.

The SCA cogeneration operations constitute a major factor in the local economy. The operations are of significant importance to the socioeconomic well being of the area. The "1990 Statistical Abstract of Utah" provides figures showing that mining accounts for 17.14% of all non-agricultural jobs and pays the highest of all non-agricultural fields in Carbon County. These figures are presented in Figure 4-2.

Local Laws Regarding Land Use Classifications

The Permit Area and adjacent areas fall within the jurisdiction of East Carbon City, Sunnyside City, and Carbon County. All three entities have zoning and land-use ordinances which allow the types of activities associated with the SCA facilities. Selected zoning information available from these entities is found in Appendix 4-4.

Cultural and Historic Resources Information

Appendix 4-5 incorporates a copy of "A Stratified Archeological Sample Survey of Kaiser Steel Corporation Sunnyside Mine Lease, Carbon County, East Central Utah." This document was obtained from the Kaiser Steel 1985 Permit on file with the Utah DOGM. This document was prepared, under contract to Kaiser Steel Corporation, by the Consulting Services Branch, Antiquities Section of the Utah Division of State History who also conducted the field survey. The survey included the entire Kaiser area in the early 1980's. The SCA permit area was a portion of the Kaiser area at that time and was included in the survey.

A cultural resource survey of the SCA Permit Area was completed by the Utah Historical Society Preservation Office Survey and Planning staff in the Fall of 1993 (Appendix 4-3). There are two sites potentially eligible for nomination with the National Register within the SCA Permit Area and adjacent area: the coke ovens located on Site 42Cb243325 (within the SCA Permit Area) and a cemetery located on Site 42Cb538 (adjacent to the SCA Permit Area). Site descriptions for each site are included in Appendix 4-1 and Appendix 4-5. Plate 4-2 shows the location of the coke ovens, the cemetery, and other sites adjacent to the SCA Permit Area which are mentioned in the following paragraphs. It should also be noted that no prehistoric sites were recorded prior to this study.

Located in Section 6, Township 15 South, Range 14 East are approximately 26 coke ovens remaining from the original 800. Coal from the mine was brought down by rail into the top of the coke ovens, and the oven was given a "charge" through a hole in the top. After 72 hours, the coked coal was removed

from an opening on the side and loaded onto another rail car. These coke ovens are the only physical remains from the era when Sunnyside coke was used widely throughout the western United States for smelting.

The site containing the cemetery consists of a badly disturbed cemetery located in the approximate center of the SCA cogeneration power plant site. It is completely riddled with prairie dog holes and vandals have been quite active, tipping over headstones. An unknown number of graves are present. The few headstones present (ca. 20, including fragments) appear to be handmade out of a variety of substances (cement, wood, wrought iron). No complete death notices are present and most of the headstones are weathered beyond recognition. What few are partially readable appear to be Hispanic names with deaths during the first decade of the 20th~~is~~ century. Several graves are enclosed by bedsteads and commercial wrought iron fencing material. SCA has erected a chain-link fence around the perimeter of the cemetery to protect it from disturbance.

There are two other sites that are listed as non-significant by the National Register and consequently, are not considered to be potentially eligible for registration as Historical Places. The first of these consists of a diffuse, non-patterned scatter of plus or minus 50 interior and secondary flakes and one possible biface fragment (Site 42Cb539) located above the head and north of Icelander Creek. The second site consists of an extensive distribution of burned coal slag and clinkers and domestic and industrial trash situated on a broad sage covered flat (Site 42Cb540). This site is located on the outskirts of East Carbon City.

Cultural and Historic Resources Sites

As stated previously, the only historic site identified within the SCA Permit Area is the coke ovens site which is located in Site 42Cb243~~325~~. The coke ovens are located about 400 meters east of Sunnyside on the edge of the refuse pile (see Plate 4-2). At the present time, twenty-six of the ovens remain. Several have been previously destroyed in the north end to accommodate the expansion of the refuse pile. The ovens are beehive-shaped with level roofs for "charging". The door openings, which all face east, are large enough to walk into a cavern about 2.3 meters high and 3 meters in diameter. Varying amounts of vandalism has occurred to the ovens and they remain in uncertain states of stability.

Within the SCA Permit Area, there are no units of the National System of Trails or the Wild and Scenic Rivers System.

Projected Impacts and Preventative Measures to Cultural and Historical Resources

The identified sites have coexisted with the Sunnyside mines for over ninety years. All sites have been affected by past activities.

There are three potential types of impacts that could affect the cultural resources in the SCA Permit Area. The first type includes naturally occurring events such as erosion, flooding, fire, landslides, earthquakes, etc. No mitigation efforts are planned for these naturally occurring impacts.

The second type of impact is vandalism. This occurs in the form of illegal excavations (relic hunting), destroying standing walls, defacing rock art or architecture with paint, target practice, etc., or illegally removing surface artifacts. Vandalism cannot be totally prevented, but can be curbed. SCA will be on the alert for, and remove people from, the sites that are on the National Register. SCA has erected a chain-link fence around the cemetery to protect it from vandalism. SCA will also enclose the area

surrounding the coke ovens with stakes, flags, signs or other markers. See Plate 3-1 for the approximate location of these markers. No construction activity will be permitted to occur within this marked area.

A third type of impact results from construction, gaining access to specific area (roads and trails), or any other human related ground disturbance. SCA will either avoid the National Register quality sites or undergo specific mitigation procedures prior to the impact of the site. At the present time, planned ground disturbance within the SCA Permit Area will not impact any known cultural resources.

Sensitivity Zones

The application of predictive models to develop sensitivity maps for cultural resource management has been completed for the original SCC Permit Area. The long term purpose of such maps is to release some areas from further requirement under federal cultural resource laws while concentrating concern on high probability areas (Reed and Nickens 1980). The result of such an attempt for this project is shown on Plate 4-3.

Three zones are outlined on Plate 4-3. The zones are designated as "high", "medium", or "low". The high density areas are limited to the primary canyon bottom and the first or second contour (12 to 13 meters) above the canyon floor, plus the valley pediment. High sensitivity areas have deep soils, open sage parks, and are at least 30-40 meters wide. Site density is about 1.12 sites per square mile. Medium sensitivity areas are limited to high altitude (2280 meter a.s.l.) flat benches. Medium sensitivity areas average about .85 sites per square mile. The remaining area is classified as low density and includes the talus/cliff slopes and the narrow (30 meters or less) secondary canyons. Average site density is less than .10 sites per square mile.

The entire SCA Permit Area is located within a high sensitivity zone. The majority of the land surrounding the SCA Permit Area lies within low sensitivity zones with the exception of a few small areas that are characterized by high altitude flat benches, consequently lying in medium sensitivity zones.

Based on the existing data, the following future management programs will be implemented in order to preserve the land within the SCA Permit Area:

1. All sites listed as eligible for nomination to the National Register of Historic Places be protected from impacts by the SCA cogeneration project. As described earlier, the areas have been fenced or will be identified with stakes and flagging so that the areas are not disturbed.

2. For eligible sites threatened by future mining impacts, SCA will instigate a program of adequate mitigation prior to impact as negotiated with the State Historic Preservation Officer.

Previous Mining Activity

The SCA Permit Area has not, and will not be used for subsurface mining operations. The SCA Permit Area that is being addressed in this report is associated only with operations related to coal mine waste disposal and excavation. Mining activities associated with disposal of coal mine waste have been occurring in this area for several decades.

411.210 Type of Mining Methods Used

Details on mining methods can be found in Chapter Nine, Mining Plan. Additional operational information is included in Chapter Five.

Coal Seams or Other Mineral Strata Mined

SCA is excavating a waste coal refuse pile rather than mining an underground coal seam.

Approximate Dates of Past Mining

The original SCC permit area has been mined continuously since the late 1890's. Over sixty million tons of coal has been extracted during this period. Kaiser Steel Corporation leased the No. 2 Mine from Utah Fuel Company in 1942 to provide coking coal to the newly constructed steel mill at Fontana, California. In 1950, Kaiser Steel purchased the entire property. Subsequently, ownership changed hands to SCC and a small portion, for which this Permit Application applies, is now owned by SCA. Plate 1-1 shows the permit boundaries and ownership of the areas surrounding the SCA Permit Area. It should be noted that there are no underground mines within the SCA Permit Area. All the underground mines lie within areas outside of the SCA Permit Area and are either abandoned or operated in accordance with other mining permits.

412 RECLAMATION PLAN

Postmining Land-Use Plan

Reclamation essentially commenced with the first ton of coal mine waste removed and used as an alternative energy fuel. Practices will be limited to excavation and handling of coal mine waste to segregate non-combustibles and redisposing of such materials in a controlled manner. SCA's operating plan for its adjacent alternative energy power plant is designed to substantially reduce the final quantity of coal mine waste which will ultimately remain within the existing refuse disposal area. Reclamation will be a continuous process over the life of the mining operation, ultimately grading, covering and revegetating any remaining non-combustible materials.

Details on interim reclamation can be found in Chapter Nine, Mining Plan. Chapter Ten, Reclamation Plan outlines components of the final reclamation plan.

The following sections outline the proposed use of the SCA Permit Area, capacity of the reclaimed land to support a variety of alternative uses, and the relationship of the proposed use to existing land-use policies and plans.

Existing land-use adjacent to the SCA Permit Area is primarily fish and wildlife habitat, limited grazing, and minimal cropland. The land-use picture has not changed significantly and is not expected to deviate in the future. Post project land use will be fish and wildlife habitat.

Soil Suitability

Several borrow areas have been identified for use as topsoil in future reclamation (Plate 5-1). A discussion of the suitability of the soils and their capability to support the post-mining land use is included in Chapter Two in the section titled "Suitability of Topsoil Substitutes."

Control Measures to Mitigate Impact

Control measures to mitigate impacts on present land-use include steps to protect surface waters, soil resources, vegetation, and fish and wildlife. Additional information can be found in Chapter Two (Soils), Three (Biology), and Seven (Hydrology) which detail mitigation measures.

Wildlife Species and Habitat Requirements

Many fish and wildlife species and their specific habitat requirements are listed in Chapter 3, Section 322. This section includes information on macroinvertebrates, fish, amphibians, reptiles, birds, and mammals. The section discusses many species which are not expected to inhabit the area in great abundance, but it is hoped that a large variety of the identified species will find the post-mine reclaimed area suitable for habitat. The wildlife species most likely to inhabit the reclaimed site would include a variety of birds; larger mammals such as deer, elk, and coyote; small mammals such as marmots, ground squirrels, chipmunks, rabbits and other ground dwelling rodents; snakes and other small reptiles; and potentially small amphibians.

Details found in Chapters Nine and Ten concerning the reclamation plan are anticipated to establish a variety of features which can provide habitat for many different species. For example, placement of rock piles provides habitat for small mammals, reptiles and amphibians; and planting groups of pinyon/juniper tublings provides habitat for larger mammals, small mammals, birds, and other wildlife.

Vegetation species which are anticipated to be established in the reclaimed site have been incorporated into the designed and approved seed mixes. The native vegetation species have been selected for the value to habitat of different wildlife species and the ability to establish themselves in this particular area. Tables 3-1, 3-2 and 3-3 provide information concerning vegetation values and species characteristics in the seed mixes. The approved seed mixes are shown in Figures 10-2, 10-3, and 10-4.

Regional Land Use

Regional land use has been fully discussed in the U.S. Geological Survey's "Final Environmental Statement, Development of Coal Resources in Central Utah, Part 1 - Regional Analysis" (1979).

In the seven-county region, Federal lands, including those of the National Forest and National Park systems, account for 76% of the land surface, while only about 7% was irrigated farm acreage. A current letter from the SCS states that there is no prime farmland within the original SCC permit area (see Figure 2-1).

The livestock industry, mostly cattle and sheep grazing, has been part of the region's historical economy. The timber industry has only a few small saw mills still operating mostly to supply fence posts, and lumber.

Land Owner or Surface Manager Comments

SCA owns the small portion of land (approximately 250320 acres) containing the refuse pile ~~and slurry ponds~~ which comprises the SCA Permit Area and either owns or leases much of the adjacent areas south, west and north of the permit area. A letter from the owner is included in Figure 4-3. This letter contains comments from David Pearce, a former Vice President of Sunnyside Cogeneration Associates, as to the proposed post-mine land use.

Mineral Ownership, Mines and Wells

Within the SCA Permit Area, there are no~~t any~~ operating underground mines nor are there any oil producing or gas wells.

Socioeconomic Considerations

Carbon County, with its low population density and isolation from Utah's urban centers, is historically an important coal-producing area in the State. The local economy is dependent upon conditions of the coal market.

Utah Department of Employment Security data indicates that in 1991, Carbon County had a total non-agricultural employment of 7,624 of which 4.03% were engaged in manufacturing; 17.14% in mining; 1.95% in contract construction; 5.72% in transportation, communications, and public utilities; 25.2% in trade; 1.82% in finance, insurance, and real estate; 26.55% in government and the remaining 17.58% in service related fields. Statistics also show that in 1988, the average monthly payroll wages for mining in Carbon County were $2,820.00 which are the highest of all the non-agricultural fields in Carbon County. This data is from the "1990 Statistical Abstract of Utah" and is included as Figure 4-2.

The SCA operations contribute a substantial share of employment, with the cogeneration operations and, indirectly, in other business. Its continued operation is of significant importance to the socioeconomic well being of the area.

Suitability and Compatibility

Land use during operation will continue to be as a fuel source for SCA's cogeneration facility and as a disposal site for coal mine waste including slurry as well as coarse or fine refuse. The effect of this operation on land use is minimal and is not expected to change during the permit period. Industrial waste from the SCA cogeneration facility will not be disposed of in the SCA Permit Area, therefore these operations should have a minimal effect on the SCA Permit Area.

The final grading will be suitable for reclamation and revegetation and will be compatible with the natural surroundings and the approved post-mining land use.

413 PERFORMANCE STANDARDS

Post-mining land use will be the same as pre-mining land use. The reclamation activities following mining are designed to allow the area to revert to the type of activity that occurred prior to mining. All disturbed areas will be restored in a timely manner to conditions that are capable of supporting land uses or higher or better uses.

The coke ovens which are located on the Northeast corner of the SCA Permit Boundary will be preserved by avoidance as recommended by the Utah State Historical Preservation Office. Operational activities and reclamation activities will be carried out such that they do not disturb the existing coke ovens.

The post-mining land uses will be the same as the pre-mining land uses. The post-mining land uses will be practical and reasonable, they will be consistent with applicable land-use policies or plans and they will not cause or contribute to violation of federal, Utah, or local law.

414 ALTERNATIVE POSTMINING LAND-USE REQUEST

~~Not applicable.~~No alternate post-mining land uses have been requested.

420 AIR QUALITY

421 THRU 423 AIR QUALITY PERMIT

SCA will continue its programs in the permit area to comply with the requirements of the Clean Air Act and other applicable air quality laws and regulations, as well as health and safety standards. SCA has not violated any air quality laws to date. A copy of the SCA's Air Quality Permit is included in Appendix 4-2. SCA will coordinate specific air quality needs with the Utah Division of Air Quality.

A weather station is located at the Sunnyside Town Hall, but no air quality monitoring devices are currently in use. Air pollution sources come from fugitive dust from the coarse refuse stockpiles and unpaved roads.

424 FUGITIVE DUST CONTROL PLAN

Effects of Mining Operations on Air Quality

Most of the region around the SCA Permit Area has been designated a Class II area for purposes of determining any significant amounts of air quality deterioration. Deterioration of the air quality is not expected during the permit period with the exception of short high wind periods when sand and smaller grained particles will be picked up outside of the SCA Permit Area and added to the air in the permit area.

The haul road used by the refuse trucks is unpaved. To control fugitive dust, roads will be maintained in accordance with SCA's Air Quality Permit (see Appendix 4-2) and as specified in Chapter Five, Sections 527 and 534.

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510 INTRODUCTION

The refuse disposal area, previously created by the Sunnyside Coal Company (SCC), has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternate fuels as sources of waste fuel for the facility. SCA's fueling plan will require excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials as discussed in Chapter Nine, will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

Currently, there are activities that occur outside the Sunnyside Cogeneration Associates Permit Boundary that have significant bearing on the operations of the SCA Cogeneration facility and the SCA Permit Area. These activities occur in conjunction with the SCA permit site.

In order for SCA to acquire the quality and quantity of fuel for the cogeneration facility, coarse or fine refuse materials may be accepted from off-site facilities as needed. The refuse is stockpiled in designated areas within the SCA permit site then mixed with existing refuse on the SCA permit site and transported to the cogeneration facility. These operations; acceptance of refuse from off-site facilities and the transporting of coarse refuse to the cogeneration facility, require access roads that extend beyond the limits of the SCA permit boundary.

In addition to the access roads mentioned above, there are access roads to the south of the SCA permit boundary that are utilized for the purposes of the SCA operations. These roads are utilized to access areas of the SCA permit site that are inaccessible from the north side of the permit area. They are used by authorized contractors of SCA for the purposes of such activities as: water quality monitoring, periodic inspections and site maintenance as needed.

Activities that occur outside the SCA Permit Area also include watersheds outside the permit area that drain into contained areas within the permit area. Chapter Seven of the Permit outlines these watersheds

and the areas to which they drain. Also included are detailed maps and calculations showing the amount of water from each watershed and the capacity of the drainages and ponds that were constructed to contain them. In some instances, a drainage commencing within the SCA Permit Area may extend beyond the limits of the SCA permit boundary. An example of this is the outlet of the Pasture Sediment Pond. In such a case, SCA commits to maintaining this drainage and providing the necessary information to the Division to show its adequacy to handle the required storm event. In the event that this occurs elsewhere within the permit area, SCA will handle each instance on a case-by-case basis and notify the DOGM of any proposed changes to the Permit.

It should be noted that the SCA operations encompass a number of entities that do not necessarily lie or operate within the permitted area. These ~~non-mining related~~ activities that occur outside of the permitted area are done so in a controlled manner under permits from other agencies, and have been incorporated into the entire design and plan of the SCA Cogeneration facility. SCA understands the implications of utilizing entities outside of the permitted area and commits to maintaining the applicable areas in accordance with DOGM requirements.

This chapter includes operation plans, reclamation plans, design criteria, and performance standards that are applicable to the SCA Permit Area. Design calculations are referenced in the appropriate sections along with maps, plans, and cross-sections. It should be noted that SCA has relied on data, maps, plans, and cross-sections from previous approved permits for the SCC mines in order to verify locations of geologic structures, sediment ponds, borrow areas, road culverts, creeks, etc. that lie within the SCA Permit Area. In this chapter where the "permit area" is referred to, the SCA Sunnyside Permit Area is to be assumed unless the larger overall area for the SCC is specifically referred to in the text as the "original SCC permit area."

512 CERTIFICATION

512.100 Cross Sections and Maps

The maps and cross sections, associated with this permit, have been prepared and certified by, or under the direction of, a qualified, registered professional engineer or land surveyor, with assistance from experts in related fields such as hydrology, geology and landscape architecture. These maps and cross sections will be updated as required by the Division of Oil, Gas and Mining (DOGM).

A list of plates that are applicable to the SCA Permit Area as required under R645-301-512.100 through R645-301-512.260 are included in the General Table of Contents.

512.110 Mine Workings

No underground mine workings exist within the SCA Permit Area. Plate 5-7 delineates the extent of surface areas previously disturbed by mining activities. Plate 5-8 shows the existing surface and subsurface facilities and features which have been associated with mining activities.

512.120 Surface Facilities and Operations

Plate 5-1 shows the location and size of existing areas of spoil, waste, coal development waste, and non-coal waste disposal, dams, embankments, other impoundments, and water treatment facilities within the SCA Permit Area. It also shows the facilities used for crushing and screening the coal refuse as well as the features associated with the adjacent cogeneration facility.

Plates 5-5 A - E shows topsoil pile cross sections.

512.130 Surface Configurations

As required under sections 542.300 and 302-200, maps or cross sections detailing plans for soil stabilization, compacting and grading are referenced in the appropriate sections.

512.140 Hydrology

Maps required under R645-301-722 and R645-301-731.700 are included in Chapter Seven, Hydrology. Among these requirements are locations of subsurface water within or adjacent to the SCA Permit Area, intakes for current users, sedimentation ponds, coal processing waste banks, and embankments. Maps are provided only when the above mentioned locations fall within the SCA Permit Area or within an adjacent area that will potentially impact the SCA Permit Area.

512.150 Geologic Cross Sections and Maps

Chapter Six, section 622, includes information applicable to the SCA Permit Area such as: elevations and locations of test borings and core samples; nature, depth, and thickness of coal seams; and crop lines and strike and dip of the coal.

512.200 thru 512.260 Plans and Engineering Designs

Plate 5-1 outlines the locations of excess spoil, durable rock fills, coal mine waste, impoundments and other surface facilities within and adjacent to the SCA Permit Area. Plate 5-2 outlines the locations of primary roads. The design of the Excess Spoil Disposal Areas is found in Chapter Nine and Appendices 9-2, 9-5, and 9-7. Coal mine waste will also be placed in the Excess Spoil Disposal Areas.

513 COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS

513.100 thru 513.800 Compliance with 30 CFR

Coal mine waste dams, embankments, impoundments, sedimentation ponds, refuse piles, the extinguishing of coal mine waste fires, and the nature and timing of reclamation activities will meet the

performance standards set forth by the MSHA. The embankments and impoundments that are regulated by the MSHA are shown in Plate 5-4, Slope Stability Criteria Map. Where applicable, SCA will comply with all MSHA Regulations and obtain all required MSHA Approvals.

A geotechnical report prepared in February 1987 and updated in June 1992 by Rollins, Brown and Gunnell (Appendix 5-5) shows that the ~~existing~~ former East Slurry Cell and the former West Slurry Cell Embankments meet the requirements of 30 CFR 77.214 and 77.215. The cross-sections for this report are shown in Plate 5-6.

Coal mine waste fires will be extinguished by placing two-feet of borrow material over the burning area. Only those persons authorized by the Operator, and who are familiar with the appropriate procedures will extinguish any coal mine waste fires. The source of borrow material may be any of the borrow areas within the Permit Area where excess material exists beyond that needed for reclamation, or from spoil material removed during the mining process, or from an acceptable off-site source. When an area is mined, the fire control materials will be placed in the Excess Spoil Disposal Area.

514 INSPECTIONS

514.100 thru 514.140 Excess Spoil Disposal Areas

A professional engineer or specialist experienced in the construction of earth and rock fills will periodically inspect the fill throughout the construction period (at least four times a year) as required by the DOGM. These inspections will be performed during critical construction periods such as: foundation preparation, installation of final surface drainage systems, and the final graded and revegetated fill. A schedule for periodic inspections is provided in Table 5-1.

A certified report will be provided by the professional engineer promptly after each inspection. The report will include any appearances of instability, structural weakness, and other hazardous conditions as well as the results of samples taken to determine the acid/toxic potential. The report on the drainage system and protector filters will also contain color photographs taken in compliance with section 514.130 thru 514.133 that are representative of the site. Photographs will accompany each certified report and will include physical features of the site in order to specifically and clearly identify the site.

A copy of each inspection report will be retained at the SCA cogeneration power plant site and at the office of the Engineer. A copy of the inspection report will be promptly sent by SCA to the Division, as required.

514.200 thru 514.250 Refuse Piles

A professional engineer or specialist experienced in the construction of earth and waste structures will inspect the refuse pile on a regular basis (at least four times a year) as required by the DOGM. These inspections will be performed during critical construction periods such as: foundation preparation, placement of underdrains and protective filter systems, installation of final surface drainage systems, and the final graded and revegetated facility. A schedule of periodic inspections is provided in Table 5-1.

Abandoned coal refuse piles are often times reactivated, and reprocessed to recover a marketable coal product. On some occasions, piles are reworked several times, using various processing approaches. SCA's activities will assure that no reworking of this pile occurs in the future, as the small amount of remaining materials will have been determined to be non-combustible. SCA's use of coal mine waste to generate electricity is consistent with our national energy policy to conserve our domestic energy resources.

523 MINING METHODS

SCA's activities will include excavation and handling of coal mine waste and redisposal of non-combustible materials within the SCA Permit Area. Approximately 410,000 tons per year of coal mine waste will be consumed by SCA. The fueling plan for the coal waste fired generator will require excavation of accumulated waste from the existing pile areas, beginning as early as January 1993, and continuing for approximately thirty years. Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by offsite preparation plants will also be factored into SCA's fueling strategy, which can allow direct acceptance of waste at the facility, or temporary placement within the refuse disposal area prior to utilization.

Detailed plans on excavation activities can be found in Chapter Nine, Section 9.6.

SCA will use a standard mobile fleet of excavation equipment which may include all or some of the following: dozers, front-end loaders, end-dump trucks, scrapers, back-hoes, and support equipment (water truck, maintenance vehicles). Excavation will be carried out in lifts, to assure continued stability of the refuse pile, while providing ability to segregate non-combustible materials as they are encountered. An advancing benched face working area will provide access to fuel along a face on each working layer. Sampling and testing will be a continuous process to insure that materials provided to SCA's cogeneration facility meet minimum levels of combustibility. Materials will be segregated as they are excavated for handling in one of three ways: 1) direct hauling to the power plant site, 2) redisposal within the SCA ~~noncombustible waste site~~excess spoil disposal areas, or 3) handled through a static grizzly on the refuse pile to separate non-combustibles (rocks, metal, timbers, etc.). Any materials separated through the grizzly will be temporarily stored in piles until loaded and transported to the combustor or the refuse disposal area. The grizzly staging area will be relocated from time to time as excavation activities warrant, and will minimize accumulations of separated materials.

523.100 thru 523.220 Surface Coal Mining and Reclamation Operations Relating to Underground Mines

No activities related to the SCA Permit Area will be conducted closer than 500 feet of an underground or abandoned underground mine. This is reinforced by the fact that there are no underground or abandoned underground mines within 500 feet of the SCA Permit Area boundary.

524 BLASTING AND EXPLOSIVES

There will be no blasting or explosives used within the SCA Permit Area. Thus, regulations 524 through 524.800 are not applicable to this Permit Application and consequently are not addressed.

525 SUBSIDENCE

No material damage or diminution within the Permit Area will be caused by subsidence because no underground coal resources are available within the Permit Area which would cause subsidence. No past or future underground coal mining operations have or are likely to occur within the SCA Permit Area.

526 MINE FACILITIES

The following sections contain narratives explaining the construction, modification, use and maintenance of facilities that lie within the SCA Permit Area and are designated in sections 526.100 through 526.300.

526.100 thru 526.116 Mine Structures and Facilities

Surface and subsurface facilities and features which existed prior to January 21, 1981 are shown on Plate 5-8 existing surface and subsurface facilities and features. Existing surface features are identified on Plate 5-1 Surface Facilities.

SLURRY HANDLING and STORAGE

The **slurry ditch** was constructed in the 1950's, for the purpose of transporting coal processing waste in slurry form from the Sunnyside Mine wash plant to the disposal sites within the current SCA permit area.

Typically, during operation of the Sunnyside coal wash plant, one slurry pond was in use while the other was in either the drying or cleaning stages. Occasionally when both slurry ponds were being serviced, flows were diverted to the East Slurry Cell. With the cessation of operations at the SCC Wash Plant, slurry is no longer being transported to the SCA Permit Area. The Excess Spoil Disposal Area #2 has been approved to fill the area of the slurry ponds and clear water pond. This ~~proposal~~ includes additional maintenance to the slurry ditch (see Appendix 9-7). The ditch meets or exceeds the permanent program performance standards. It is of sufficient size to safely pass the design storm as calculated in Appendix 7-3.

The **West Slurry Cell** (formerly MSHA No. 1211-UT-09-02093-03) was located near the center of the permit area. The cell was constructed in the 1950's as a disposal site for fine coal refuse slurry. Wet slurry was last deposited in this cell in 1975 when the East Slurry Cell was put in operation. Since then, dry coal fines from other slurry cells as well as coarse refuse from the Sunnyside Mine have been placed in the cell. This area was actively mined by SCA during the first years of operations.

A dike was constructed of non-combustible earth materials across the existing wash to impound the slurry. This dike was subsequently covered with coarse refuse material to stabilize the west bank of the slurry cell in order to meet the permanent program performance standards under SMCRA. This dike material was excavated during the SCA operations. The West Slurry Cell has been excavated to the point where it no longer is considered an impoundment and has been decommissioned by MSHA. The area is now only referred to as the Refuse Pile.

The **East Slurry Cell** was~~is~~ located adjacent to and on the east side of the former West Slurry Cell. The

cell was constructed in 1974 primarily of coarse refuse material. The pond was constructed with a total capacity of 184 acre-feet. The East Slurry Cell wasis a temporary control structure with former MSHA No. 1211-UT-09-02093-02. The structure wasis a temporary impoundment as addressed in R645-301-733. ~~The structure is addressed by the MSHA criteria of 30 CFR 77.216(a). Storm runoff captured by the impoundment is allowed to evaporate or infiltrate. The SCA operations attempt to minimize the surface area from which precipitation runoff is allowed to flow into the East Slurry Cell.~~ The structure has been excavated to the point where it is no longer an impoundment and has been decommissioned by MSHA as such and the area is now considered part of the Refuse Pile.

The outer slopes of the east bank of the East Slurry Cell were reclaimed by the Sunnyside Coal Mine. SCA intends to excavate the suitable coarse refuse and the fine refuse from the cell in accordance with the mining plan outlined in Chapter Nine. Regular monitoring is conducted in accordance with the regulations for the Refuse Pile ~~this structure~~. These monitoring reports are available at the mine site. See Appendix 7-3 for hydrologic calculations. This cell meets or exceeds the permanent program performance standards.

Slurry Ponds #1 and #2 and the Clear Water Pond were located near the northeast corner of the permit area. They were constructed during the 1970's to de-water the slurry from the Sunnyside coal wash plant. Fine refuse slurry material arrived from the coal preparation wash plant by way of the open slurry ditch. The ponds were designed to be used for de-watering, settling and filtration of the coal fines.

~~During typical, operations of the Sunnyside Coal Company's coal wash plant, one slurry pond was in use while the other was in either the drying or cleaning stages. Occasionally when both slurry ponds were being serviced, flows could be diverted to the East Slurry Cell and runoff did not go into the Clear Water Pond. Routine flow of the coal fines was manually controlled by the Sunnyside Coal Mine. The coal fines and sediment were allowed to fill to a maximum level that allows sufficient remaining volume in the pond to contain the design storm runoff.~~

~~The ponds were partitioned with a filter dike. The filter dike for Slurry Pond 2 was retro-fitted in 1993 with a filtering fabric to reduce the migration of coal fines into the Clear Water Pond. The water filtered through to an eight inch outlet pipe that routed it to the Clear Water Pond for further settling. The eight-inch pipe was the only outlet from the Slurry Ponds. The Slurry Ponds were primary sediment structures with the Clear Water Pond providing final treatment prior to discharge to the Icelander drainage. At no time did the slurry ponds discharge directly to the Icelander Drainage.~~

~~These two slurry ponds were temporary impoundments as addressed in R645-301-733. They were not addressed by the MSHA criteria of 30 CFR 77.216(a). They met the single channel spillway exemption of R645-301-743-132 by meeting the requirements of R645-301-742.225.2. **Slurry Pond #1** had a total record volume of 16.4 acre-feet (top of bank). **Slurry Pond #2** had a total record volume of 15.3 acre-feet (top of bank).~~

The Excess Spoil Disposal Area #2 has filled the area of the slurry ponds and ~~is approved to fill~~ the Clearwater Pond (See Appendix 9-7). The Pasture Pond was enlarged in 2007 to receive storm water previously received by the Slurry Ponds and / or the Clear Water Pond.

Other impoundments within the SCA permit site are also discussed in Section 526.300 Water Pollution Control Facilities as well as in Chapter 7 and Appendix 7-3. Regular monitoring of all impoundments is conducted in accordance with R645-514. These monitoring reports are available at the mine site and are submitted to the Division as required. All impoundments meet or exceed the permanent program performance standards.

COARSE REFUSE HANDLING and STORAGE

Construction of the **REFUSE PILE (MSHA ID Number 1211-UT-09-02093-01)**, which SCA is excavating, began prior to 1969. The western toe of the pile was extended to the west in the 1970's to provide a stable embankment for the West Slurry Cell that existed at the time and meet the permanent program performance standards. Additional refuse material was added to the top surface of the refuse pile by the Sunnyside Coal Mine as recently as 1994.

Plates 9-4 identifiesy the location and extent of the coarse and fine refuse that has been deposited by the Sunnyside Coal Mine over the past decades and outlines the intended mining sequencing as SCA excavates the refuse usable as fuel for the adjacent power plant. The information used to create these mine sequencing plantes comes from a study conducted by John T. Boyd Inc. and has been included in Appendix 9-1 of the permit as a reference.

Temporary storage areas are identified on Plate 5-19-2. These areas were approved by DOGM in 1993. They are adequately graded to provide surface drainage towards an approved diversion which flows to an approved sediment pond. These areas meet or exceed the permanent program performance standards.

Refuse Haul Roads are appropriately identified and classified on plates 5-2. They are graded and maintained to meet or exceed the permanent program performance standards. Transportation facilities are further discussed in Section 527. The south portion of the Old Coarse Refuse Haul Road, constructed by Sunnyside Mine in the 1970's, was reclaimed by SCA in 1994 (see Plates 10-2).

The **Crushing and Conveyance Structures** located at the north end of the permit area were constructed in 1992. The permit boundary was increased in 1994 to include these facilities. Plate 5-1 identifies the structures within the permit area as well as the adjacent cogeneration facility. A narrative description of the facilities is in Chapter Five. These facilities are maintained and operated to comply with the appropriate MSHA requirements and to meet or exceed the permanent program performance standards.

The **Excess Spoil Disposal Area** #1 (MSHA # 1211-UT-09-02093-04) is currently under construction and will continue to be constructed throughout the life of the cogeneration facility. This area west of the Refuse Pile was identified in 1993, for permanent disposal of excess spoil and coal mine waste. The permanent disposal area will be constructed and maintained to meet the permanent program performance standards. Regular inspections will be conducted in accordance with R645-301-514.

Foundation studies conducted have determined that the area is appropriate for this permanent disposal facility within the constraints of its design. Surface water is diverted around the disposal area. This site is not a slurry cell and large quantities of wet waste are not disposed of in the pile. No existing seeps or water sources were identified, therefore, concerns about acid leachate were determined negligible. Under-drains were determined to be unnecessary. See Plates 9-1, Chapter nine, and Appendices 9-2, and 9-5 for design criteria.

The Excess Spoil Disposal Area #2 has been proposed for constructionis under construction in the northeast portion of the Permit Area. In essence, this small disposal area is designed to fill the two former slurry ponds and the Clearwater Pond with excess spoil and coal mine waste.

This permanent disposal area is proposed to be constructed and maintained to meet the permanent program performance standards. Regular inspections will be conducted in accordance with R645-301-514. See Plates 9-8, Chapter Nine and Appendix 9-7 for design criteria.

The temporary storage area west of the Pasture pond for **Non-Coal Waste** was identified in 1993. This area will be used as described in Chapter Nine for the temporary storage of non-coal waste until such time as the material can be disposed in an appropriate local landfill. The storage area will be maintained in accordance with the permanent program performance standards. The **Industrial Waste Dump**, utilized by the Sunnyside Mine since the 1970's, was closed and capped with 18 inches of clay material as described in Chapter nine. This former dump site is now used by SCA as Temporary Storage Area #2.

Topsoil was removed prior to all new surface disturbance and construction which commenced following enactment of laws requiring its protection. The topsoil is stored in stockpiles on the permit site. After the useful life of these areas from which the topsoil was removed, the topsoil will be used to reclaim the area in accordance with the reclamation plan. All topsoil piles on the SCA permit area are appropriately identified and protected. They have been revegetated for interim soil protection, and adequate berms are in place to contain eroded sediment from the piles as calculated in Appendix 7-7. They meet the permanent program performance standards. See plates 5-5 for cross-sections and volumes of the stockpiles.

The **Revegetation Test Plots** (Sacco Flats Test Plots), located in the north-east portion of the permit site, were constructed by the Sunnyside Mine in the Fall of 1985. The SCA permit boundary was enlarged in 1993 to include the entire plots. These test plots are maintained to meet the permanent program performance standards. Annual maintenance includes items such as fence repair and other items identified as necessary.

526.200 thru 526.222 Utility Installation and Support Facilities

The only utilities within the SCA Permit Area are power lines which are shown in Plate 5-1. These power lines are maintained by Utah Power and Light. All operations will be conducted in a manner which minimizes damage, destruction, or disruption of services provided by these UP&L electric lines.

Support facilities, of which there are currently none on-site, will be operated in accordance with a permit issued to SCA for the refuse disposal area. Plans and drawings for each support facility to be constructed, used, or maintained within the SCA Permit Area include a map, appropriate cross sections, design drawings, and specifications sufficient to demonstrate how each facility will comply with applicable performance standards. In addition to the other provisions of R645-301, support facilities will be located, maintained, and used in a manner that:

1. Prevents or controls erosion and siltation, water pollution, and damage to public or private property; and

2. To the extent possible using the best technology currently available - minimizes damage to fish, wildlife, and related environmental values; and minimizes additional contributions of suspended solids to stream flow or runoff outside the SCA Permit Area.

526.300 Water Pollution Control Facilities

The water pollution control facilities within the SCA Permit Area include sediment ponds and diversion ditches.

Sedimentation control ponds are used to store and/or treat water runoff from disturbed areas up to and including a 10-year, 24-hour event. Designs of the ponds and diversions are located in Appendix 7-3. Details (including design drawings and calculations) for all sediment control ponds and diversion ditches are included in Chapter Seven, Section 720.

All sediment ponds will be inspected as outlined for impoundments in Section 514.

Sediment removed from the ponds will be disposed of in the excess spoil area. If the material is to be used as a borrow material, the material will first be sampled and tested to verify its quality. Material to be reused as topsoil substitute must meet acceptable classifications according to the Table Two from the DOGM Guidelines for Management of Topsoil and Overburden and must comply with the Title V Coal Program Guideline for Disposal of Sedimentation Pond Waste, dated November 26, 1990. The operator will contact DOGM to receive approval of the location and the amount of material to be used. All impoundments meet or exceed the permanent program performance standards.

526.400 Air Pollution Control Facilities

SCA will continue its programs in the permit area to comply with the requirements of the Clean Air Act and other applicable air quality laws and regulations, as well as health and safety standards. A copy of the SCA Air Quality permit is included in Appendix 4-2.

Most of the region around the SCA Permit Area has been designated a Class II area for purposes of determining any significant amounts of air quality deterioration. Deterioration of the air quality is not expected during the permit period with the exception of short high wind periods when sand and smaller grained particles are picked up outside of the SCA Permit Area and added to the air in the permit area.

The haul roads used by the refuse trucks are unpaved. To control fugitive dust, roads around the main complex which are being used by mobile equipment will be treated with calcium chloride, potassium chloride, or other acceptable biodegradable, organic wetting agents or sprayed with water as required during dry periods as required by SCA's Air Quality Permit.

NON-MINING RELATED ACTIVITIES

~~To comply with a requirement from the Utah Division of Air Quality, a small meteorological station was installed on the south ridge near the Excess Spoil Disposal Area (See Plate 5-1). The weather station was installed during the Summer of 1994 in connection with the non-mining related activities of the adjacent cogeneration facility. At the completion of the air monitoring study, this station maybe removed without prior approval of DOGM.~~

Terra-Tek, a drilling company, has been testing drill bits periodically since 1975 in an area in the western portion of the current SCA Permit Area. They generally drill to a maximum depth of about four feet. The area where drilling typically occurs is identified on Plate 5-1. Sunnyside Coal Company allowed Terra-Tek to conduct these non-mining related activities while the area was part of their permit. SCA will

likely allow the drilling to continue until such time as it conflicts with the SCA operations. The Division was notified by letter dated March 17, 1993 of SCA's intentions regarding Terra-Tek.

527 TRANSPORTATION FACILITIES

The roads within the SCA Permit Area are shown on Plate 5-2. Also included on Plate 5-2 is a table showing widths, grades and lengths of each road within the SCA Permit Area. Plates 5-2 (C, D, G, H, J) AND 5-3~~C through 5-2J, excluding Plate 5-2I,~~ include typical cross-sections for the roads and plan and profiles of each road. All roads located within the Refuse Pile area are pit roads and will adjust as required throughout the operational period.

Roads within the SCA Permit Area will be maintained during the permit period. Maintenance will consist of basic custodial care to control erosion, repair of structures and drainage systems, removal of debris from culverts and ditches, and replacement of road surface material as needed. Additionally, all unpaved roads being used by mobile equipment and other unpaved operational areas will be water sprayed and/or chemically treated as necessary to reduce fugitive dust as required by SCA's Air Quality Permit.

In the event of a catastrophic event, roads will be repaired as soon as possible after the damage has occurred. Furthermore, there are no plans to alter any natural drainage way, or make alterations involving a steep cut slope.

~~All t~~Transportation facilities will be properly maintained and then restored at the end of the cogeneration plant life to prevent damage to fish, wildlife, and related environmental values, as well as to prevent additional contributions of suspended solids to stream flow or runoff outside the SCA Permit Area. Appendix 5-7 includes a description of each road and structural stability calculations for the roadway embankments. A few roads are identified in the reclamation plan to remain beyond reclamation to provide access through the permit area. Additional information on final reclamation of roads can be found in Chapter Ten. All transportation facilities meet or exceed the permanent program performance standards.

WASTE COAL HANDLING SYSTEM DESCRIPTION

The following sections discuss operations involving the use of the crushing facility. The crushing system utilizes the following units:

1. Waste coal receiving hopper (Truck Dump);
2. Transfer conveyors;
3. Primary and Secondary Crusher System;
4. Product Transfer/Stacking Conveyors/ Screen Station
5. Silo Storage/Transfer Conveyors; (Not in Permit Area)
6. Live-Storage Silos (Not in Permit Area).

The SCA Permit Area was enlarged to include the crushing units on May 16, 1994. The items 5 and 6 are not within the permit area. These facilities are associated only with the power plant operation and are not part of the mining process. The SCA crushing unit exists solely to appropriately size all material utilized in the SCA plant. This sizing is required regardless of the origination of the fuel. All material, whether it be run of mine ("ROM") coal or waste coal, will be run through the receiving hopper and crushed and sized accordingly.

It is anticipated that the SCA project may need to purchase six to seven thousand tons of ROM coal per year. This coal will typically be utilized when the waste fines have been frozen and are less accessible. There may be other circumstances when ROM coal will be utilized by the SCA facility.

Plate 5-1 shows the location of the crushing facility in relation to the SCA Permit Site. Material to be burned in the plant is run through the crushing and conveyor system and stored in the silos based on the B.T.U. values, etc. Then, material is fed from the silos through a conveyor system into the power plant and the boiler. The fluidized bed boiler requires material to be crushed to a certain specification. Therefore, it is important the SCA crushing unit size the material correctly.

The waste coal pile acquired in the early 1990's ~~owned by SCA~~ represented~~s~~ approximately 23 years of fuel supply on the ground. Since ~~If~~ the SCC mine ~~were to~~ ceased operations ~~today~~ within a few years after SCA's acquisition of the refuse area, SCA has obtained additional sources of material for its operation. ~~could be required to transport material to its site, either~~ This has included mixing ROM coal with its current waste coal supply ~~to extend the life of the pile, or purchasing~~ and obtaining additional waste materials from other sites. All these materials must go through the crushing system that SCA has on site to meet boiler specifications for fuel.

It is important to know that no matter where material is obtained, whether it be from SCA's DOGM permitted areas, ROM coal, or waste material from another site, this material is all directly fed into the waste coal receiving hopper and sized and crushed accordingly. SCA is not unique in this process. All coal fired power plants have crushing units on site to prepare fuel for boiler specifications.

The following paragraphs include a detailed description of the waste coal handling system for the SCA cogeneration facility.

The handling system provides for receiving Waste Coal from two independent sources, including screening the material according to size, with the oversize material being crushed to a 1/4" top size, and storage in segregated, enclosed silo systems, (1,800 tons total capacity), according to BTU content, (high or low), for reclamation in a proportioned blend by the plant operating system (provided by others).

The system also provides for: weighing incoming material as it is received, with printed record; removal of metals via electro-magnet, with backup metal detection of the final product; and, the ability to segregate crushed product into an open, dead-storage pile for emergency reclamation, if needed. Dust control features of the system include totally enclosed live-storage silos and transfer points, covered conveyor systems and a water-spray type dust suppression system at transfer points, as needed.

Waste Coal Receiving Hopper

Material from the Waste Coal piles will be received in an 100 ton capacity, ramped, drive-over Waste Coal Receiving Hopper designed with slope angles to ensure the flowability of wet, sticky coal.

The hopper slopes are lined with high molecular weight plastic sheeting ("slick sheet") to enhance flowability as well as to act as a replaceable wear surface. Air cannons are provided in the lower hopper walls to provide for flow activation for the fine pond material. The hopper is open, above grade, on one side to provide a "push-in slot" for receiving coal by dozer when needed.

Dust control is accomplished with a water-type suppression system to "fog" the hopper volume during unloading of dry gob materials.

Transfer Conveyors

Waste coal flows from the Waste Coal Receiving Hopper on a slow-speed, troughing conveyor (200 tph effective capacity) which feeds a transfer conveyor (250 tph effective capacity) that feeds the Primary Crusher. The Receiving Hopper conveyor belt is a heavy duty 3-ply belt to resist bruising and tears at this high impact point of loading.

A self-cleaning electro-magnet is mounted on the transfer conveyor to remove metals. A metal detector is mounted over the transfer conveyor downstream of the magnet as a protection element for the screening/crushing system. Additionally, a belt scale system (+ 1/4% accuracy) weighs all incoming material, with printed record.

Primary and Secondary Crushers

The Primary Crusher receives material from the transfer conveyor and sizes it to a nominal 1.5" size. Crushed material from the Primary Crusher is deposited on the next conveyor which then feeds the Secondary Crusher. Dust control for the Primary Crusher is a water-type suppression system.

The Secondary Crusher receives material from the Primary Crusher and sizes it to a nominal 1/4" size. A dust collection system is provided for the Secondary Crusher.

Product Transfer/Stacking Conveyors/Screen Station

Sized material from the Secondary Crusher flows onto a 36" Product Transfer conveyor (250 tph effective capacity) which transfers it to a 36" Radial Stacking Conveyor (250 tph effective capacity). The product is then conveyed either, to the Screen Station, to an open-pile for placement in dead storage, or to the Silo Storage Conveyor for transfer to the live-storage silos.

The single deck Screen Station separates the crushed product at 1/4". A 60" transfer conveyor takes the minus 1/4" product to the Transfer/Loader Hopper.

A 36" conveyor takes the plus 1/4" product from the screen to a temporary stockpile. This product is then transported to the Waste Coal Receiving Hopper (Truck Dump) to be reprocessed. A closed loop return conveyor transfers this material directly to be recrushed in the Secondary Crusher without the need for the temporary stockpile.

A 24" Transfer Conveyor and a 30" Radial Stacker transfer a portion of the screened product from the Screen Station to an open pile for dead storage.

Dust Control for the Product Transfer and Stacking Conveyors and the Screen Station is a water-type suppression system and is applied as follows: immediately following the Secondary Crusher, at the transfer point between the 36" Product Transfer Conveyor and the 36" Radial Stacker, and at the outlet of the Screen Station.

The Transfer/Loader Hopper is mounted above the Silo Storage Conveyor. The Transfer/Loader Hopper is lined with slick sheet.

Silo Storage/Transfer Conveyors

The Silo Storage/Transfer Conveyors are located adjacent to the Permit Area and are associated with the power plant operation. The Silo Storage Conveyor is a stationary, troughing conveyor (250 tph effective capacity), which conveys product which has either been transferred directly from the Radial Stacking Conveyor, or reclaimed from the dead storage pile, to a transfer point on top of the first of three Live-Storage Silos.

Transfer points on top of each silo are semi-enclosed, with Y-gate chutes on the first two silos to direct the product into the silo, or onto the Silo Transfer Conveyors which connect to adjacent silos. The chute work is lined with slick sheet to enhance flowability.

Live-Storage Silos

The Live-Storage Silos are not located within the Permit Area. They are not associated with the mining operations. The three Live-Storage Silos are steel, totally enclosed cylindrical silos with cone hoppers (23,950 cubic feet total capacity each). Hopper angles are a minimum 60 degrees to ensure free flow of material during reclamation. A manually-operated, positive shut-off gate is included at the hopper outlet to provide for maintenance of adjacent mechanical equipment (to be provided by others).

Other silo features include bin level indicators and air-cannon flow activators. The silos are mounted with the outlets at the appropriate level, near grade, to provide for transfer of material by feeder systems onto the plant feed conveyor (to be provided by others).

528 HANDLING AND DISPOSAL OF COAL MINE WASTE

The applicability of Section 528 is related to handling of excess spoil and coal mine waste only. Details on the excavation of the coal mine waste can be found in Chapter Nine, Sections 9.6 through 9.7.

Excess Spoil Disposal Areas

Excess spoil will be placed in an Excess Spoil Disposal Area, designated on Plates 9-1A, 9-1B, 9-1C, and 9-1D or on Plates 9-8 A-D, in a controlled manner to ensure mass stability and prevent mass movement during and after construction. The disposal site will be designed and constructed to ensure that leachate and drainage from the area is controlled and does not degrade surface or underground water. Wastes will be routinely compacted and covered to prevent combustion and wind-borne waste. When the disposal is completed, a minimum of eighteen inches of soil cover will exist over the site and the site will be revegetated in accordance with the approved reclamation plan.

The Excess Spoil Disposal Areas will be inspected as required in Section 514.

Additional information concerning spoil disposal is outlined in Chapter Nine and Appendices 9-2, 9-5 and 9-7.

Slurry Ponds

Fine refuse from the SCC preparation plant was previously moved to dewatering or disposal areas by slurry transport in an open ditch. There were four slurry ponds within the SCA Permit Area: the West

Slurry Cell, the East Slurry Cell, Slurry Pond One, and Slurry Pond Two. The East and West Slurry Cells were settling and evaporating impoundments that were constructed prior to or during 1974. Slurry Ponds One and Two were settling ponds. Presently, the SCC preparation plant is no longer in operation. Slurry Pond One and Slurry Pond Two have been filled in connection with Excess Spoil Area #2. The East Slurry Cell ~~is storing slurry fines and receives surface runoff.~~and t~~T~~he West Slurry Cell have been~~was~~ excavated to the point that they are~~it~~ no longer ~~is an~~ impoundments.

The former slurry facilities have been incorporated within approved Excess Spoil Disposal Areas or Refuse Piles which are designed, maintained and inspected (addressing hydrology, structural stability and other operation al conditions) in accordance with requirements for their current use.

~~The West Slurry Cell was the first impoundment to be constructed for the disposal of slurry and coal mine waste in the late fifties to early seventies (Appendix 5-2). Coal mine waste and other waste was used as fill material to block a wash in the pediment material at the mouth of Whitmore Canyon overlooking the Icelander Drainage. Slurry from the preparation plant was transported to the impoundment by ditch for disposal. As the level of the slurry increased, additional coal mine waste was added to the top and sides of the impoundment. The present level of the slurry in the impoundment is over 200 feet above the bottom of the wash.~~

~~The East Slurry Cell was constructed in 1974 on the east side of the West Slurry Cell. Coal mine waste was placed and compacted in dikes. After the dikes were completed and covered with soil material, the impoundment was filled with slurry. After 1983, the impoundment was used as an overflow for the former Slurry Ponds One and Two.~~

~~Slurry Ponds One and Two were constructed in 1978 to the north of the East and West Slurry Cells. These ponds were constructed by excavating a depression in the colluvium at a gentle slope. Material from the depression was spread out down slope of the ponds for approximately 50 to 100 feet. Slurry Ponds One and Two were used in rotation. Slurry was introduced into a pond where it settled and was then filtered. During the use of the first pond, the second pond was decanted and the dried slurry removed by truck to the West Slurry Cell. After the second pond was cleaned, the cycle was reversed. If both ponds were in the drying and cleaning cycle, the slurry was diverted to the East Slurry Cell. Water from Slurry Ponds One and Two was discharged into the Clear Water Pond (UPDES Outfall #004) and then discharged to Icelander Drainage.~~

~~All surface drainage from the areas above the slurry ponds is diverted away from the embankments by diversion ditches designed to carry the peak runoff from 100 year, 6 hour precipitation event (Appendix 7-3). The diversion structures will be maintained to prevent blockage.~~

~~Visual inspections by a qualified registered professional engineer or a qualified MSHA impoundment inspector will be conducted according to 30 CFR 77.216-3 and/or R645-301-514.300 to assess the stability of the impoundments and determine the amount of seepage, if any.~~

Subsidence will not affect the ~~ponds and embankments~~areas since the structures do not overlie the coal seam and are located several miles west of the nearest outcrop. Mud flows, rock debris falls or other landslides are not expected to be a problem because the embankments are located at or above the level of the surrounding topography. Possibility of failure downhill of the embankments is limited to a thin layer of colluvial material on bedrock. Failure of this material would not threaten the embankments.

Coarse Refuse

Detailed cross sections and grades for the Coarse Refuse Pile ~~and East Slurry Cell~~ are shown in Plate 5-6. This plan shows the limits of the coarse refuse pil~~e, as well as the slurry cell~~.

The coarse refuse disposal area is located on and is part of the west embankment of the former West and East Slurry Cells. The West Slurry Cell was constructed in the late 1950's to impound coal slurry from the Sunnyside mine's preparation plant. Coarse refuse material was added to the top and sides of the impoundment as the slurry level increased. The West Slurry Cell ceased being used as a settling pond in 1975 when the East Slurry Cell was built. Since that time, SCC continued to use the west embankment of the West Slurry Cell as the coarse refuse disposal area to stabilize the embankment and ultimately allow continued use of the West Slurry Cell.

The existing coarse refuse pile was built in lifts by leveling end dumped piles of material. The coarse refuse pile maintains a maximum 27 degree (2 horizontal:1 vertical) outslope and is terraced on 50-foot vertical increments. The terrace is a minimum 20-foot wide and is gently sloped to control surface water runoff and control erosion.

Geotechnical investigation of the West Slurry Cell embankments were conducted in 1984 and again in 1986. The 1984 work (Appendix 5-3) indicated that the West Slurry Cell embankment above the active coarse refuse disposal area was not stable with a static safety factor of 1.03. The study concluded that a safety factor of 1.46 would be obtained by maintaining maximum slopes of 2 (h) : 1 (v) and maintaining a moist compacted material density of 100 lbs per cubic foot. SCC continued stabilization of the west embankment by wheel compacting coarse refuse in lifts, maintaining 50-foot high benches at a maximum 2 (h) : 1 (v) slope, and establishing a minimum 20-foot terrace at every bench.

A 1986 report (Appendix 5-5) developed for a proposed coarse refuse pile expansion to the north of the existing coarse refuse pile, concluded a 2 (h) : 1 (v) slope between 50-foot high benches and terraces of 30-feet in width, while maintaining a moist compacted material density of 100 lbs per cubic foot provides an adequate factor of safety (greater than 1.5) under static conditions.

Cross-sections ~~C-C', D-D', and E-E'~~ (shown in Plate 5-6) indicate the coarse refuse pile embankment maintained the slope and bench criteria established in the geotechnical investigations. Recent in-place density testing (Appendix 5-6) indicated moist compacted densities greater than 100 lbs per cubic foot as established in the geotechnical investigations.

The coarse refuse pile will be in a state of ongoing excavation throughout the permit period. A side view of the coal mine waste excavation is shown in Figure 5-1. Excess spoil material and coal mine waste not suitable as fuel will be separated from the combustible material going to the Cogeneration Plant; transported and placed in a controlled manner in horizontal lifts not exceeding four feet in thickness; concurrently compacted as necessary to ensure mass stability and to prevent mass movement during and after construction; graded so that surface and subsurface drainage is compatible with the natural surroundings; and covered with topsoil or substitute material if required. The Excess Spoil Disposal Areas are shown in Plates 9-1A, 9-1B, 9-1C, 9-1D, and 9-8 A-D.

All surface drainage from the area above the refuse pile will be diverted away from the fill into stabilized diversion channels designed to pass safely the runoff from a 100-year, 6-hour precipitation event. Calculations are found in Appendix 7-3.

The refuse pile will be inspected as outlined in Section 514.

Maintenance of the embankments will consist of filling and grading any erosion or other failure features

542.700 Final Abandonment of Disposal Area

Following the excavation of the coal mine waste the remaining material will be regraded to approximately re-establish the surface contours that existed before mining operation disturbances. Revegetation efforts will be initiated following the excavation and regrading activities. See Chapter Nine, Mining Plan for details on contemporaneous reclamation. Chapter Ten, Reclamation Plan includes details on final reclamation.

550 RECLAMATION DESIGN CRITERIA AND PLANS

Approximately 75 percent of the disturbed portions of the SCA Permit site was originally disturbed prior to the current reclamation laws. Plate 5-7 identifies the previously-mined areas.

See Chapter Nine for contemporaneous reclamation details. See Chapter Ten for final reclamation details.

560 PERFORMANCE STANDARDS

Coal mining operations will be conducted in accordance with this permit as approved and with the performance standards of the permanent program.

Primary Roads

- Graded to a minimum side slope of 2%.
- Minimum six-inch cut ditch to collect drainage.
- Dust control techniques actively applied on roads being used by mobile equipment as needed to meet the requirements of the approved Air Quality Permit issued by UDEQ.

Ancillary Roads

- Graded and maintained to adequately serve the purpose of providing access as needed.

Sediment Ponds

- Operated and maintained to protect against any discharge which exceeds the limits set by the approved UPDES Permit issued by UDEQ.
- Periodically monitored, and sampled if needed, as required by the UPDES Permit.
- Sediment level will not reach an elevation higher ~~then~~than the inlet to the decant drain pipe.
- Sized adequate to contain and/or treat the 10-year, 24-hour precipitation event.
- Side slopes not steeper than 2H:1V.
- Spillway adequately clean and clear from sediments or debris to allow safe discharge of the 25-year, 6-hour precipitation event.

Topsoil Storage

TABLE 5-1
INSPECTION SCHEDULE FOR THE EXCESS SPOIL DISPOSAL AREAS, REFUSE PILE AND ALL IMPOUNDMENTS

TABLE 5-1
INSPECTION SCHEDULE FOR THE EXCESS SPOIL DISPOSAL AREAS, REFUSE PILE AND ALL IMPOUNDMENTS

AREA TO INSPECT	ACTION REQ'D	FREQUENCY	REGULATION #
Excess Spoil Disposal Area #1 (Noncombustible Waste Site)	1	Quarterly[4]	R645-301-514.110 30 CFR 77.216
Excess Spoil Disposal Area #2	1	Quarterly	R645-301-514.110
Refuse Pile	1	Quarterly	R645-301-514.220
Pasture Pond	2	Quarterly	R645-301-514.330
Coal Pile Sediment Pond	2	Quarterly	R645-301-514.330
Old Coarse Refuse Road Pond	2	Quarterly	R645-301-514.330
Coarse Refuse Toe Pond	2	Quarterly	R645-301-514.330
Rail Cut Pond	2	Quarterly	R645-301-514.330
Borrow Area Pond	2	Quarterly	R645-301-514.330
~~East Slurry Cell~~	~~2, 5~~	~~Monthly~~	~~R645-301-514.320 30CFR77.216-3~~
~~East Slurry Cell~~	~~3, 5~~	~~Annually[4]~~	~~30CFR77.216-4~~

1. Inspect for appearance of instability, structural weakness, and other hazardous conditions.
   NOTE: These inspections will be performed during critical construction periods such as: foundation preparation, placement of underdrains and protective filter systems, installation of final surface drainage systems, and the final graded and revegetated facility.
2. Inspect for appearance of instability, structural weakness, and other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability.
3. Describe any changes in the geometry of the impounding structure; instrumentation; average and maximum depths and elevations of the impounded water, sediment or slurry impounded; and any other aspect of the impounding structure affecting its stability.
4. Annual reports will be submitted to the MSHA district manager.
5. Impoundments meeting the criteria specified on 30 CFR 77.216 shall comply with the MSHA-Approved Program for Impoundment Inspections (PAP Appendix 5-8).

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611 GENERAL REQUIREMENTS

The refuse disposal area, previously created by the Sunnyside Coal Company (SCC), has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternate fuels as sources of waste fuel for the facility. SCA's fueling plan will require excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials as discussed in Chapter Nine, will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

All geologic materials and data required by R645-301-600 to evaluate this Permit Application are included or referenced. It should be noted that SCA has compiled and relied on data and maps from previous approved permits ~~applications~~ for the SCC mines. The Geology section has been appended to reflect the permit area of the SCA. In this chapter where the "permit area" is referred to, the SCA Sunnyside Permit Area is to be assumed unless the larger overall area for the SCC is specifically referred to in the text as the "original SCC permit area."

The geology discussion centers around the SCA Permit Area and areas immediately adjacent to the permit area. The text, maps and figures which describe the geology within the SCA Permit Area are found in section 624 GEOLOGIC INFORMATION. The general geologic setting of the Book Cliffs coal field, of which the SCA Permit Area is a part, is presented together with a review of previous geologic studies of the area. Stratigraphy, structure and coal geology in the permit area and surrounding vicinity are covered with appropriate illustrations.

The SCC mine has been in continuous operation for over eighty years. Coal mine waste from the SCC mine has been disposed on the SCA Permit Area for a number of years. However, as previously discussed, the SCA Permit Area is separate from the Sunnyside Coal mine, and is now separately owned by SCA. Coal quality, mining conditions and other operational parameters have been documented in the SCC mines' records. Previous SCC permit applications are on file with the Utah Division of Oil, Gas, and Mining (DOGM).

The geological and hydrological characteristics of the original SCC permit area and the surrounding areas have been described in numerous government and private publications. Data for this chapter were drawn particularly from the following publications of the U.S. Geological Survey:

"Final Environmental Statement, Development of Coal Resources in Central Utah" (1979) [1]

"Coal Resource Occurrence and Coal Development Potential Maps of the Sunnyside Quadrangle, Carbon County, Utah." Open File Report 79-491 (1979) [2]

"Coal Resource Occurrence and Coal Development Potential Maps of the Patmos Head Quadrangle, Carbon County, Utah." Open File Report 79-492 (1979) [3]

Osterwald, F.W., J.O. Mayberry and C.R. Dunrud, 1981, Bedrock, Surficial, and Economic Geology of the Sunnyside Coal-Mining District, Carbon and Emery Counties, Utah: United States Geological Survey Professional Paper 1166, U.S. Government Printing Office, Washington, D.C.

The geologic descriptions of the area within and adjacent to the permit area in accordance with R645-301-621 through R645-301-627 are included in those sections as required. The materials and information requested under regulations 611 through 611.200 are also included.

612 CERTIFICATION

Cross sections, maps, plans, and analytical data included in this chapter have been taken from previous permit applications on file at DOGM; or from previously issued reports prepared by other consultants. As such, the appropriate cross sections, maps, and plans were certified by the authors. SCA has relied on data, maps, plans, and cross-sections from previous approved permits for the SCC mines in order to verify material for this permit.

620 ENVIRONMENTAL DESCRIPTION

621 GENERAL REQUIREMENTS

This Permit Application includes a description of the geology within and adjacent to the SCA Permit Area. Included in the text under 624.100 are descriptions of the general stratigraphy, structure, and geochemical evaluations of the coal mine waste in the SCA Permit Area.

622 CROSS SECTIONS, MAPS AND PLANS

The cross sections, maps and plans are referenced as needed in the following sections. A list of plates that are applicable to the SCA Permit Area are included in the General Table of Contents.

622.100 Elevations and Locations of Test Borings and Test Samplings

The locations of test borings and test samplings that have been drilled within the SCA Permit Area are presented in Plate 6-1. The approximate elevations of the borings, in feet above mean sea level, are based on the topography current at the time of boring and are listed as follows. ~~in Plate 6-1, and are presented on the following page~~.

Boring #	Elevation	Boring #	Elevation	Boring #	Elevation
1	6525	10	6530	91-6	6510
2	6525	11	6520	91-7	6515
3	6545	12	6510	91-8	6510
4	6525	13	6510	91-9	6515
5	6520	91-1	6520	91-10	6380
6	6520	91-2	6520	91-11	6350
7	6520	91-3	6515	91-12	6520
8	6520	91-4	Not avail.	91-13	6520
9	6510	91-5	6510		

Additional borings were completed in August 1992 by John T. Boyd Company. Appendix 9-3 presents the findings from the Boyd investigation including boring logs.

622.200-300 Nature, Depth, And Thickness of Coal Seams

Geologic formations beneath the permit area are stratigraphically below the coal-bearing formations in the Sunnyside area. Coal seams do not appear to occur beneath the permit area. Therefore, no material damage or diminution is expected within the Permit Area due to subsidence. No past or future underground coal mining operations have or are likely to occur within the SCA Permit Area. However, a discussion of the stratigraphy and coal geology in the Sunnyside area is presented in section 624.100.

622.400 Existence of Gas and Oil Wells

No oil and gas wells are within the permit area, according to DOGM records.

623 REQUIRED GEOLOGIC INFORMATION

This Permit ~~Application~~ includes geologic information which will assist in determining potentially acid- or toxic-forming material, and determining whether reclamation as required by R645-301 and R645-302 can be accomplished. UNDERGROUND COAL MINING has not occurred within the SCA Permit Area, and is not planned to occur within the SCA Permit Area. Subsidence control is therefore not applicable. The geologic information is presented in sections 624-624.340.

See Section 624.220 through 624.230 for information on acid- or toxic-forming materials.

624 GEOLOGIC INFORMATION

624.100 Description of Geology in Permit and Adjacent Areas

Regional Geologic Setting

In the Book Cliffs coal field, of which the original SCC permit area is a part, elevations range from 4,000 to 6,000 feet along the base of the Book Cliffs to nearly 10,300 feet at the highest point. The south-flowing Green River and the tributary Price River both cut through the Book Cliffs as do lesser streams that have cut canyons in the Book Cliffs.

The main coal beds in central Utah are exposed in the south-to-southwest facing Book Cliffs that bound the Roan Plateau. They are also exposed in a similar manner by the southeast facing cliffs of the Wasatch Plateau. The rocks of this continuous, roughly U-shaped bed partly surround and dip gently away from the broad regional dome of the San Rafael Swell. Steep escarpments and canyons are prominent features, above which are gently rolling plateaus, and below are pediments and plains.

Clark (1928) mapped the geology and coal outcrops in the western part of the Book Cliffs coal field from the Standardville 7-1/2 minute quadrangle on the west to Patmos Head quadrangle on the east. Fisher (1936) mapped the eastern part of the coal field. The geology and coal deposits in the area have also been described by Abbot and Liscomb (1956), Fisher, Erdmann, and Reeside (1960), Hayes and others (1977), Bordsky (1960), and Young (1955, 1957, and 1966). Osterwald (1962) has made a detailed study of the structural features in the area of the Sunnyside No. 1 Mine. Doelling's work (1972) summarizes geology and coal data reported in earlier writings. A geologic map of the Sunnyside mines area prepared by S.B. Montgomery in 1976 is included as Plate 6-2.

Stratigraphy

Rocks that crop out in and adjacent to the SCA Permit Area are Upper Cretaceous in age and include, in ascending order the Mancos Shale; the Mesa Verde Group, which includes the Blackhawk Formation, Castle Gate Sandstone, and Price River Formation; the Flagstaff Limestone and North Horn Formation;

The strata and coal seams generally dip north and eastward away from the outcrop at 5° to 8°. Several faults with displacements from 3 to 20 feet trend N 25° W across the worked out area. The cover varies from 200 feet in the Raise area to over 2,000 feet in the longwall areas. Rugged topography and high relief create a marked difference in cover thickness within a few hundred feet horizontally.

Local Geology of SCA Permit Area

As previously discussed, only the Mancos Shale and Quaternary Alluvium crop out within the SCA Permit Area. Much of the SCA Permit Area is covered by the actual coal mine waste. The locations of cross sections in the SCA Permit Area are presented in Plate 6-1. Plates 6-3~~6-4, 6-5, and 6-6~~ presents geologic cross sections through parts of the SCA Permit Area.

According to the Hydrogeologic Map (Plate 6-2), no faults were mapped within the SCA Permit Area. It is assumed that beds of the Mancos Shale follow regional strike and dip as discussed above.

624.110-130 Cross Sections, Maps, and Plans and Geologic Literature and Practices

The cross sections, maps, and plans required for the SCA Permit Area are listed in the General Table of Contents. Impacts on other areas of the Sunnyside Coal Mine Company's mining operation are not addressed.

624.200 Removal of Strata for the Purposes of Surface Coal Mining and Reclamation Activities

UNDERGROUND COAL MINING will not take place within the SCA Permit Area. However, for purposes of this permit ~~application~~, the removal of the coal mine waste to the cogeneration plant is considered to be Surface Mining of Coal Mine Waste.

624.210 Lithologic Characteristics

Exploratory borings were drilled through the refuse pile within the SCA Permit Area in an effort to obtain data on lithology and thickness of the coal mine waste (see Appendices 6-1, 6-2, and 9-3). Boring logs that show the lithologic characteristics of the refuse pile within the SCA Permit Area are included with the reports presented in Appendices 6-1, 6-2 and 9-3.

The refuse pile consists of slurry pond refuse, up to 35 feet in thickness, and coarse and fine coal mine waste, up to 182 feet in thickness. Analyses of the coal mine waste are included in tabulations 1 through 4, which are included in the report in Appendix 6-1.

624.220 thru 624.230 Chemical Analysis - Acid- or Toxic-Forming or Alkalinity-Producing Material and Sulfur

Chemical analyses of the coal mine waste are presented in tabulations 1 through 4 in the report in Appendix 6-1. Chemical analyses of a coal sample from the Sunnyside Coal Company mines are presented in Figure 6-4. A report entitled Special Coarse Refuse Use Study Report by Kaiser Steel in 1981 (see Appendix 6-3) concluded that the coal mine waste was non-toxic and non-acidic.

In February 1981, a Special Coarse Refuse Use Study Report was prepared by John S. Huefner that discusses samples that were taken of the coarse refuse and raw material which verified the refuse to be non-toxic and non-acidic. The chemical testing was done by American Chemical and Research lab in Provo and by Ford Chemical lab in Salt Lake City. Only one sample of refuse tested by Ford Chemical showed the manganese to be three times above the allowable limit, however, this does not show-up in other samples. This report, however, omits analysis of the Acid-Base Potential, Selenium and Boron.

Figure 6-4 presents a test report of an analysis of a sample of raw coal from the SCC mine. The analysis was performed by Commercial Testing and Engineering Company. Analysis of this sample shows low pyritic and total sulfur content as well as other quality characteristics. Representatives of the SCC mine indicated at the time that these results were similar to other samples that they had reviewed during past years.

Appendix 6-5, "Drilling and Sample Collection, and Monitoring Well Installation, West Slurry Cell and Coarse Refuse Pile," was revised based on discussions with DOGM and approved by the Division on April 28, 1995. SCA conducted the described program in August of 1995. Henry Sauer was on site representing the Division to observe the field operations. Sample analysis was performed by ACZ Laboratories. Appendix 6-7 contains a report summarizing the general characterization of the refuse pile. Some of the samples analyzed showed an acidic potential which was slightly greater than the neutralizing potential. The analysis did not provide evidence of potentially toxic materials. Precipitate materials, suspected by DOGM to exist at the interface between the refuse material and the underlying soil material, were not found in the drilling. Water was not found during drilling in a quantity sufficient to take a sample for analysis. The samples of the underlying soil material did not have characteristics which cause concern for special reclamation considerations.

The excess spoil disposal areas will be constructed as outlined in Appendices 9-2, 9-5, and 9-7. Analysis to determine the acid- and/or toxic-forming and alkalinity producing potential of the waste material disposed in the excess spoil disposal area will be performed for the constituents outlined in Appendix 9-5 which was based on the Division's "Guidelines for the Management of Topsoil and Overburden." The objective of this sampling program will be to identify areas within the Excess Spoil Pile that may cause problems for reclamation. One Grab sample per acre will be taken from each 4-foot lift of the Excess Spoil Pile immediately following the completion of each lift and throughout construction of pile. The sample will be prepared as outlined. Results of the sampling shall be submitted to the Division with the Quarterly Engineering Inspection Reports.

Four grab soil samples were taken in the West Slurry Cell in August 1993. A preliminary analysis of the surface soil samples for potential acid/toxic-forming materials is found in Appendix 6-6.

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710 THRU 712 INTRODUCTION

The refuse disposal area, previously created by the Sunnyside Coal Company (SCC), has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternate fuels as sources of waste fuel for the facility. SCA's fueling plan will require excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials as discussed in Chapter Nine, will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

The information in this chapter includes hydrologic resources (both surface and groundwater), proposed operations and potential impacts on hydrology, methods and calculations used in hydrologic design. Performance standards and reclamation activities are discussed in Chapter Nine and Ten.

Cross sections, maps, plans, and analytical data included in this chapter have been taken from previous ~~applications~~ approved permits for the SCC mines on file at the Utah Division of Oil Gas and Mining (DOGM); or from previously issued reports prepared by other consultants. As such, the appropriate cross sections, maps, and plans were certified by the authors. It should be noted that SCA has compiled and relied on data and maps from previous approved permits for the SCC mines. The hydrology section has been appended to reflect the SCA Permit Area. In this chapter where the "permit area" is referred to, the SCA Sunnyside Permit Area is to be assumed unless the larger overall area for the SCC is specifically referred to in the text as the "original SCC permit area."

Currently, there are activities that occur outside the Sunnyside Cogeneration Associates Permit Boundary that have significant bearing on the operations of the SCA Cogeneration facility and the SCA Permit Area. These activities occur in conjunction with the SCA permit site.

In order for SCA to acquire the quality and quantity of fuel for the cogeneration facility, coarse or fine refuse materials maybe accepted from off-site facilities as needed. The refuse is stockpiled in designated areas within the SCA permit site then mixed with existing refuse on the SCA permit site and transported to the cogeneration facility. These operations, acceptance of refuse from off-site facilities and the transporting of coarse refuse to the cogeneration facility, require access roads that extend beyond the limits of the SCA permit boundary.

In addition to the access roads mentioned above, there are access roads to the south of the SCA permit boundary that are utilized for the purposes of the SCA operations. These roads are utilized to access areas of the SCA permit site that are inaccessible from the north side of the permit area. They are used by authorized contractors of SCA for the purposes of such activities as: water quality monitoring, periodic inspections, and site maintenance as needed.

Activities that occur outside the SCA Permit Area also include watersheds outside the permit area that drain into contained areas within the permit area. Chapter Seven of the Permit outlines these watersheds and the areas to which they drain. Also included are detailed maps and calculations showing the amount of water from each watershed and the capacity of the drainages and ponds that were constructed to contain them. In some instances, a drainage commencing within the SCA Permit Area may extend beyond the limits of the SCA permit boundary. An example of this is the outlet of the Pasture Sediment Pond. In such cases, SCA has provided the necessary information to the Division to show its adequacy to handle the required storm event. All disturbed area runoff is diverted into approved sediment ponds. In the event that this occurs elsewhere within the permit area, SCA will handle each instance on a case-by-case basis and notify the DOGM of any proposed changes to the Permit.

It should be noted that the SCA operations encompass a number of entities that do not necessarily lie or operate within the permitted area. The non-mining related activities that occur outside of the permitted area are done so in a controlled manner, under permits from other agencies, and have been incorporated into the entire design and plan of the SCA Cogeneration facility. SCA understands the implications of utilizing entities outside of the permitted area and commits to maintaining the areas in accordance with applicable requirements.

713 IMPOUNDMENT INSPECTIONS

There are ~~eight~~ six existing impoundments within the SCA Permit Area which have been, and will continue to be used during the operation and reclamation periods. These impoundments will control sediment from SCA's refuse excavation activities. The impoundments are described in sections 732 and 733. All impoundments will be inspected quarterly for structural stability and proper performance by a qualified individual, in accordance with R645-301-514.300, as required in regulation 713. A copy of the inspection report will be promptly sent by SCA to the Division, as required.

720 ENVIRONMENTAL DESCRIPTION

721 HYDROLOGIC RESOURCES

This section of the Permit Application describes the groundwater and surface hydrology for the SCA Permit Area, and adjacent areas. Cross sections and maps showing the locations of subsurface and surface hydrologic features are described here, and are found in the exhibits of this chapter. The locations of monitoring stations used to gather baseline data on water quality and quantity are provided in these maps.

Groundwater has been encountered in the permit area on a limited basis. The various drilling records discussed in Chapter Six do not indicate the presence of groundwater in any of the holes drilled in the SCA Permit Area. This includes some holes over 200 ft deep, which reach the bed rock.

~~The only~~Two perennial surface streams are located nearby, but not within the SCA Permit Area ~~is Icelander Creek~~. Grassy Trail Creek, which drains Whitmore Canyon, is a perennial stream which flows through the area ~~immediately~~ north of the SCA Permit Area. Tributaries to Icelander Creek flow near~~around~~ both the northwest and the south borders of the SCA Permit Area. The surface water hydrology is discussed in greater detail in various sections of this chapter.

A more detailed description of surface and groundwater hydrology is found within Section 722 with water quality issues being discussed in Section 724.

722 CROSS SECTIONS AND MAPS

A list of plates that are applicable to the SCA Permit Area are included in the General Table of Contents.

722.100 Location and Extent of Subsurface Water

As discussed in Section 721, drilling records of the SCA Permit Area show that little groundwater was encountered in the holes drilled in the SCA Permit Area. This includes drill holes over 200 ft. deep and into bedrock.

722.200 Location of Surface Water Bodies

The natural surface streams in and adjacent to the SCA Permit Area include Grassy Trail Creek (north of the SCA Permit Area) and Icelander Creek tributaries (~~border~~ near the northwest and southern portions of the SCA Permit Area). No water from Grassy Trail Creek enters the permit area, and no water from the SCA Permit Area discharges into it. Therefore, Grassy Trail Creek is not discussed further in this chapter.

West of the northern portion of the SCA Permit Area is a spring which feeds Icelander Creek. The location of this spring is shown in Plate 7-2. It is labeled by its monitoring station number, F-2.

The SCA Permit Area has been used as the refuse disposal area for the SCC mines for many decades. Sedimentation ponds have been constructed in the area, with collector ditches, to control runoff sediment from the roads and disturbed areas.

The locations of all the water bodies mentioned above are shown on Plate 7-~~1~~2. All water bodies mentioned above, except Grassy Trail Creek, are discussed in more detail in various sections of this chapter.

722.300 Location of Monitoring Stations

The Surface and Groundwater Monitoring Locations are shown on Plate 7-2. The locations of UPDES water monitoring sites are shown separately on Plate 7-1.

722.400 Location of Water Wells

There is only one water well within a 1-mile radius of the SCA Permit Area. It is located north of the western portion of the permit boundary near the railroad tracks. The well location is shown in Plate 7-2. This well is certified as having a 200 ft collection gallery which begins at the bottom of a 42' concrete sump. The water right is described in section 724.100.

722.500 Contour Maps

The contours of the SCA Permit Area are shown in Plate 7-1. The topography of the area is also shown in cross sections AA', BB', and CC', (Plates 6-4 through 6-6). Cross section locations are shown in Plate 6-~~3~~1.

723 SAMPLING AND ANALYSIS

All water quality analyses and sampling will be performed according to the methodology set forth in the current edition of "Standard Methods for the Examination of Water and Wastewater" or according to the methodology in 40 CFR Parts 136 and 434.

724 BASELINE INFORMATION

724.100 Ground Water Information

An underground water rights search showed one appropriated water well in the area adjacent to the SCA Permit Area. The water rights are held by East Carbon City, but will be used by SCA in the cogeneration facility pursuant to a contract. The certificate of appropriation is shown in Figure 7-1. The search was conducted on a 1-mile radius around the south quarter corner of section 6, T 15 S, R 14 E. The results of the water rights search are shown in Figure 7-2.

There is a spring approximately 1/4 mile west of the SCA Permit Area. This spring and the East Carbon City well are both shown in Plate 7-2. The spring, labeled F-2, flows into Icelander Creek, and becomes subject to the water rights and irrigation uses of Icelander Creek. This spring is also the subject of a contract between East Carbon City and SCA. The water from the spring will be used in the cogeneration facility. Baseline water quality data is found in Appendix 7-4.

The historic Coarse Refuse Seep emerged near the toe of the existing Coarse Refuse Pile. This seep was the subject of a special study conducted (1994-1995) by SCA in coordination with DWQ. The operations of SCA are expected to have a net improvement on the water quality in this area.

724.200 Surface Water Information

Icelander Creek

Tributaries to Icelander Creek are found near the northwest and southern boundaries of the SCA Permit Area. One tributary lies just outside of the northwestern border, another tributary lies just ousidecuts in and out of the southern border. The Utah Division of Water Quality has classified Icelander Creek as 3C (protected for non-game fish and other aquatic life, including the necessary organisms in their food chain), and 4 (protected for agricultural uses including irrigation of crops and stock watering).

Drainage and Sediment Control System

There is a system of collector ditches throughout the permit area to collect runoff from roads and disturbed areas. These flow into the sedimentation ponds found periodically around the permit boundary. These ponds outfall into the previously mentioned Icelander tributaries, if they fill to their decant drains. The discharges to the Icelander drainage must be adequate in quality to be suitable for the irrigation uses downstream. The discharges are subject to the UPDES permit limitations discussed later in this chapter. Alternate Sediment Controls may be placed as needed to improve erosion control.

The sedimentation ponds are described as follows:

Outfall No.	Location	
007	Rail Cut Pond Lat: 39° 32' 14" Long: 110° 23' 48"	Surface runoff discharged from sediment ponds to Icelander Creek.
008	Old Coarse Refuse Pond Lat: 39° 32' 20" Long: 110° 23' 03"	Surface runoff discharged from sediment ponds to Icelander Creek.
009	Pasture Pond Lat: 39° 32' 36" Long: 110° 23' 58"	Surface runoff discharged from sediment ponds to Icelander Creek.
012	Coarse Refuse Toe Lat: 39° 32' 28" Long: 110° 23' 58"	Surface runoff discharged from sediment ponds to Icelander Creek.
014	Coal Pile Sediment Pond Lat: 39° 32' 38" Long: 110° 23' 32"	Sedimentation Pond to contain runoff from the crushing areas. Discharge to Icelander Creek.
016	Borrow Area Pond Lat: 39° 32' 25" Long: 110° 23' 45"	Sedimentation pond containing runoff from soil borrow area. Discharge to Icelander Creek.

The Surface and Groundwater Monitoring Locations shown on Plate 7-2 and listed in Appendix 7-8 on Table 7-2A were monitored for two years (June 1993-1995) according to the Baseline parameters listed in Table 7-2B. This baseline data has been analyzed and incorporated into Appendix 7-4.

The baseline data presented in Appendix 7-4 appears to indicate the following attributes:

- The decreased flows and temperature and the increased pH at the Coarse Refuse Seep Monitoring sites indicate that previously alleged flows through the refuse pile from slurry dewatering in the East Slurry Cell have either ceased or have been substantially reduced to a negligible amount.

- The stiff diagrams for the Coarse Refuse Seep monitoring sites indicate that the CRS, CRC, and CRB have similar water quality characteristics. They are rich in sulfate, magnesium, and calcium. The similarity of the stiff diagrams for the Coarse Refuse Seep monitoring sites deserves comment. Even though a significant increase in flow occurs between the CRS and the CRB, there is not a significant reduction in sulfate, magnesium, calcium or in the level of TDS. It is generally accepted that the increased flows near the boundary are not related to the refuse pile. Therefore, since those increased flows have similar water qualities, it is likely that the earlier increases in flows are also not related to the refuse pile. The inability to find water during the exploratory drilling of the refuse pile in August

1995, supports the theory that water is not flowing through the refuse pile and causing the coarse refuse seep.

- The stiff diagrams for the Dragerton Well, Icelander Creek and F-2 Whitmore Spring monitoring sites indicate that they have similar water quality characteristics. They have a balanced chemistry of Sodium and Sulfate and moderate amounts of Magnesium. The close similarities lend support to the concept that these water sources are connected (water flowing through the surface alluvium is sampled at the well, comes to the surface at Whitmore Spring and flows into Icelander Creek). These stiff diagrams also indicate that Icelander Creek has not been significantly affected by the characteristics (such as higher sulfates) at the Coarse Refuse Seep.

- The Total Dissolved Solids (TDS) of CRS, CRC and CRB samples was much higher than at the Dragerton Well, Icelander Creek and F-2 Whitmore Spring. High TDS is a common attribute of water flowing through mancos shale formations as suspected of the water at this seep. These characteristics lend support to the concept that the low TDS water sites are connected and do not flow through mancos materials, but seep water flows through mancos type materials prior to surfacing.

The water quality data shows that previous discharges from station 004 (Clearwater Pond) generally met the limitations of the UPDES permit. The Clearwater Pond no longer exists and surface waters are now processed through other sediment ponds. The sediment ponds do not generally have discharge.

There are a few disturbed areas within the permit area that do not report to a sediment pond. Alternate Sediment controls provide water treatment as described in Appendix 7-7.

724.300 thru 724.320 Geologic Information

The geology of the surrounding areas described in detail in section R645-301-624. In summary, the SCA Permit Area consists of alluvial fan deposits overlying pediment deposits, which overlay a deep Mancos Shale layer. The Mancos Shale is exposed along the southern border of the permit area. The combined alluvium and pediment deposits range from in thickness from a few feet to about one hundred feet. This natural geology has since been overlaid with refuse in several areas of the SCA Permit Area.

There has been very little groundwater encountered in the SCA Permit Area drilling explorations, and consequently the proposed operations are projected to have a negligible effect on groundwater. The operations will not affect the surface water quality. The proposed excavations will be designed such that the existing ~~and~~ sedimentation ponds will not be disturbed.

724.400 thru 724.410 Climatological Information

A statement of climatological factors which are representative of the SCA Permit Area are included in sections 724.411 thru 724.413. These factors include estimates of average precipitation, prevailing winds, and seasonal temperature ranges. Climate averages and data were obtained from The Utah Climate Center at Utah State University. The data tables are found in Appendix 7-2. The measurements were made at the Sunnyside mine weather station, which operated from 1984 thru 1988, and at the Sunnyside City Center station which has operated since 1989. The averages reported here are from the five years of data measured at the Sunnyside mine station.

724.411 Average Precipitation

The average annual precipitation for the Sunnyside area is 15 inches. The rainfall amounts are fairly evenly distributed from March to November, averaging 1.4 inches per month. The total snowfall accumulations average 41 inches per winter. Snow can begin in October and can continue through April.

724.412 Average Wind Direction and Velocity

The Utah Weather Guide estimates that the wind velocities, in the area of the Price weather station, average 3.3 miles per hour for an entire year. March and April have the highest wind averages. The average velocity for these months is 5 miles per hour for the entire month. No prevailing wind direction is listed in the Weather Guide.

724.412 Seasonal Temperature Ranges

The hottest month in the Sunnyside area is July. The average maximum temperature for a day in July is 82°F, the average minimum temperature is 54° F. The coldest month is January, with an average daily maximum of 33° F, and an average daily minimum of 12.9° F.

724.420 thru 724.500 Additional Information

No additional or supplemental information has been requested by DOGM at this time.

724.600 Survey of Aquifer Recharge Lands

Groundwater aquifers have not been encountered in the SCA Permit Area. The drilling records presented in Chapter Six, Geology, suggest that if an aquifer does exist, that it is deep in the Mancos Shale layer, or lower. The proposed operations will therefore have negligible effect on groundwater aquifers.

724.700 Alluvial Valley Floor Determination

The following discussion demonstrates that the SCA Permit Area and the downstream areas receiving discharge from the SCA Permit Area are not appropriately classified as alluvial valley floors. The proposed operations should therefore not be subject to the special requirements of R645-302.320.

Statutory language specifically excludes "upland areas" for consideration as alluvial valley floors [P.L. 95-87, 701(1)]. The areas to be excluded from consideration include the upper portion of alluvial fans, pediment surfaces, etc. Areas underlain by bedrock and covered with residual weathered material and debris deposited by sheet and rill wash are also upland areas.

All of these descriptions can be applied to the SCA Permit Area. The geology of the SCA Permit Area consists primarily of alluvial fan and pediment deposits, at the base of the Book Cliffs, in the lower Price River drainage. In the steeper southern and western portions of the SCA Permit Area the bed rock Mancos Shale layer is very near the ground surface. Just a few feet of sheet and rill wash cover this layer. Further to the south and west is an area classified as additional alluvial fan deposits.

Icelander Creek tributaries flow through the areas to the south and to the northwest of the SCA Permit Area; however, it is a small creek and has carved only a shallow channel in the alluvial fan deposits. All the surface discharge from the SCA Permit Area flows into the Icelander drainage.

In 1985, the Division found that Grassy Trail Creek, from approximately five miles east of East Carbon City to the confluence of Grassy Trail Creek with Slaughter Canyon, was the only Alluvial Valley Floor (AVF) within the Permitted Area of Kaiser Coal Corporation. At the recommendation of DOGM, SCA has included a copy of Plate III-29 from the Kaiser 1985 permit for the purpose of delineating the designated AVF (see Figure 1 of Appendix 7-9).

The area now identified as the SCA Permit Area was then included in the Kaiser Coal Permit Area. However, the area identified as an AVF is not part of the SCA Permit Area. The AVF is located to the northeast and at a higher elevation from the SCA Permit Area.

The Division further found that the proposed operation of Kaiser Coal "will include neither the extraction of coal nor will significant physical disturbance of the surface or groundwater regime associated with the AVF occur and that mining activities actually enhance farming activities on the AVF."

The Division thus waived the requirements of UMC785.19(d) and (e) and UMC822 which deal with additional technical information, findings, and performance standards required of operations affecting designated AVFs. (See Appendix 7-9).

The proposed operations of SCA, which include excavating the coal refuse pile deposited by the operators of the Sunnyside Coal Mine, are expected to result in a net improvement to water quality.

SCA requests that the Division wave the requirements which deal with additional technical information, findings, and performance standards required of operations affecting designated AVFs.

725 BASELINE CUMULATIVE IMPACT AREA INFORMATION

725.100 thru 725.300 Hydrologic and Geologic Information

Hydrologic and geologic information from federal and state agencies has been used to generate this Permit Application. Other information was gathered from studies and surveys conducted by SCA, or its predecessors in this project. A great deal of information regarding potential impacts on the hydrologic balance of the area by the proposed excavation and reclamation activities was obtained from studies and surveys conducted by SCC or their predecessors at the Sunnyside mines. The information presented in this Permit is provided as a resource for DOGM use to assess the probable cumulative hydrologic impacts of the proposed excavation and reclamation operations on surface and groundwater systems in the cumulative impact area as required by R645-301-729.

726 MODELING

No modeling or statistical parameter interpolation techniques were used to determine any of the information presented to fulfill the regulations of this chapter. Only data from actual observations and laboratory testing is presented as baseline information here.

727 ALTERNATIVE WATER SOURCE INFORMATION

The proposed refuse excavating operations will not have an effect on the current water quantity and quality downstream of the permit area. Because of this, no alternate water sources have been determined.

728 PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION

728.100 thru 728.300 Determination of PHC

A description of probable hydrologic consequences related to the hydrologic regime and the quantity and quality of water under seasonal conditions is presented within this section. The PHC determination is established from baseline information presented in this chapter, and in Chapter Six (Geology).

728.310 Impacts to the Hydrologic Balance

The hydrologic conditions in terms of water quality could be affected by two types of activities: application of water for fugitive dust control and evaporation from sediment ponds within the Sunnyside Cogeneration Permit Area. The fugitive dust control will consume certain amount of water through spraying water on the unpaved roads in use. The sediment ponds and/or slurry cells will increase water evaporation losses.

There are approximately 1.2 miles of roads to be sprayed to control fugitive dust (including upper and lower Haul Road and the Coal Access Road) within the permit area. From April through October, three trips for spraying are needed per day on average. From November through March, two trips per month are needed. This gives a total of 649 trips per year. To assume that the average road width is 30 feet and an 1/8-inch water depth per trip is needed, a total of ((649x1.2x5280x30x0.125)/(12x43560)) = 29.5 acre-feet of water is needed for fugitive dust control per year. This amount of water will be totally evaporated. Adequate underground water rights from the East Carbon / Dragerton well are available to SCA to meet the needs of dust control. Figure 7-1 includes documentation concerning SCA's water right to the East Carbon / Dragerton Well.

There are six~~eight~~ sediment ponds ~~and/or slurry cells~~ within the permit area (as shown in Plate 7-1). ~~Except for the East Slurry Cell,~~ each pond has an outlet structure. The outflow from each pond will eventually be discharged to Icelander Creek. ~~There are no outlet structures for the East Slurry Cell. The~~

~~East Slurry Cell receives water from the slurry ditch. . Water in the East Slurry Cell will eventually evaporate to the atmosphere or infiltrate through the slurry deposited within the cell. The infiltrated water may eventually drain to the Icelander Creek.~~

Conservatively estimated, there is a total water surface area of less than 8 acres for the ponds. For the purposes of this calculation, it is assumed that there is one storm which is equivalent or greater than 10-year 24-hour storm each year, and that the dewatering time for each pond is five days (0.167 month). Also it is assumed that the storms will occur from April to September when evaporation is higher. From the Utah Weather Guide (Brough, et al, 1983), Price Station (#7026), there is an average monthly pan evaporation rate of eight inches. Assume a pan evaporation correction factor of 0.7, there is total annual evaporation loss of (8x8x0.7x0.167/12) = 0.6 acre-feet.

~~The total water surface area for the East Slurry Cell is approximately 17 acres. If a full cell needs 15 days (0.5 month) to infiltrate to empty, conservatively estimated, the evaporation loss will be (17x8x0.7x0.5/12) = 4 acre-feet.~~

The total water loss from fugitive dust control and pond evaporation is ~~34.1~~30.1 acre-feet per year. Thus, the proposed operations will slightly affect the existing stream hydrological conditions in terms of water volume.

COARSE REFUSE SEEP

The Coarse Refuse Seep has been effectively dry since the mid 1990's. The water that historically emerged from the base of the coarse refuse pile was alledged to have had two possible sources. One source could have been that water trapped in the alluvium under Grassy Trail Creek could be flowing over the Mancos Shale contact and through faults, cracks, joints or other pipes to emerge at the toe of the refuse pile. The other source could have been water from the East Slurry Cell infiltrating through fill material to the toe of the coarse refuse pile. Slurry water has not been delivered to the SCA permit site since January 1994. Continued drying of the cells and decreasing flows in the seep leads to the projection that even if water previously flowed through the refuse material, that potential contribution in the future is minimal and possibly even non-existent. The refuse pile characterization program, conducted by SCA in August 1995, did not find evidence of water flowing through the refuse pile (see Appendices 6-5 and 6-7). Historic water quality data for this seep is presented in Appendix 7-6. Further water monitoring was conducted in 1994 and 1995 and is presented in Appendix 7-4. The parameters and frequency of testing were coordinated with the Department of Water Quality. Additional information concerning this seep can be found in Chapter Nine.

Three v-notch weirs have been installed in the coarse refuse seep drainage as shown on Plate 7-1. The weirs were installed in locations that are already disturbed. These areas will be reclaimed by removing the weirs and reseeding in accordance with the reclamation plan. The weirs were installed by excavating a small trench (either with a small rubber-tire back hoe or digging by hand) and back filling around the weir. Sediment was controlled during construction by installing rows of straw bales ~~as shown on Plate 7-1~~. These straw bales ~~will be left in place to~~have deteriorated over time and~~. They~~ will not ~~need to~~ be replaced. Rip rap was placed below the notch on the downstream side of the weirs to control erosion throughout the useful life of the weirs. The weirs will be kept clear of sediment buildup and otherwise maintained by SCA authorized personal to provide accurate flow readings. Additional straw bales may be placed in the flow prior to maintenance work. These will also be left in place to deteriorate over time and will not need to be replaced.

appropriate for the environment and for the proposed excavation activities. Figure 7-1 includes documentation concerning SCA's water right to the Dragerton Well.

A monitor well was installed at the toe of the refuse pile in accordance with a Permit from the State Engineer in accordance with the exploratory drilling program detailed in Appendix 6-5. All monitoring inspections to date, at the well have found it dry.

731.500 thru 731.522 Discharges into and out of Underground Mines

The proposed operations of this Permit Application consist only of excavation of coal mine waste and refuse piles. Therefore this section does not apply.

731.600 thru 731.620 Stream Buffer Zones

All disturbance caused by the proposed operations will be well over 100 feet from any natural stream. Therefore this requirement does not apply.

731.700 Cross Section and Maps

731.710 Water Supply Intakes and Waters Receiving Discharge

All discharges from the SCA Permit Area flow into tributaries of Icelander Creek. ~~This is shown in Plates 7-3 and 7-6.~~ Icelander Creek is not currently used as a culinary or irrigation supply.

731.720 Map Showing Diversions, Conveyance and Treatment Facilities

This requirement does not apply because Icelander Creek is not currently being used for culinary, irrigation, or industrial uses.

731.730 Locations of Monitoring Stations

The locations of the monitoring stations used to gather baseline information on water quality and quantity are shown in Plate 7-2. The locations of UPDES discharge monitoring sites are shown separately on Plate 7-1. These locations are identified in the field with metal posts and labels.

731.740 Map Showing the Locations of Sediment Ponds

The locations of the sedimentation ponds are discussed in section 733 and are shown in Plate 7-1. Plate 5-6 also shows the location of the refuse pile.

731.750 Cross Sections for Each Sediment Pond and Other Impoundments

See Section 732.

731.800 Water Rights

The majority of the rights in the area are held by the municipalities, SCA, and a few land owners. The rights mostly relate to Grassy Trail Creek and discharges from the Grassy Trail Reservoir created by the construction of a dam approximately 5-6 miles up Whitmore Canyon. The operations taking place on the SCA Permit Area do not affect any currently held water right.

732 SEDIMENT CONTROL MEASURES

732.100 Siltation Structures

The existing siltation structures which are a part of the refuse disposal, and proposed refuse excavation activities will be maintained to comply with the requirements of this regulation. Siltation structures that impound water are considered herein as treatment facilities and sedimentation ponds. A discussion of these facilities is set forth in Section 732. Alternate Sediment Controls may be placed as needed to improve erosion control.

732.200 Sedimentation Ponds

732.210 Compliance Requirements

There are six~~seven~~ impounding structures in the SCA Permit Area which are all shown on Plate 7-1. ~~Out of the seven impounding structures,~~ These six ~~are~~ sedimentation ponds serv~~e~~ing the disturbed portions of the SCA Permit Area. Each sedimentation pond is governed by an UPDES permit which controls water quality discharges. ~~(The East Slurry Pond is not a discharging impoundment, its discharge is captured by another sedimentation basin)~~ Operational requirements of the six sedimentation ponds located in the SCA Permit Area as outlined by this regulation will be met. Detail designs related to the facilities are given in Appendix 7-3.

Below is an outline of various design parameters for the sediment ponds found within the SCA Permit Area.

Pond Description	Reference Plate	Maximum Depth (ft)	Volume (acre-ft)
Coarse Refuse Toe	7-7	9.5	1.6
Rail Cut	7-8	8	4.8

Pasture	7-9	7.5	3.2
Old Coarse Refuse Road	7-10	6.0	0.9
Borrow Area Pond	7-11	9.5	8.3
Coal Pile Sediment Pond	7-18	7	1.5

Topsoil stockpile sediment will be controlled by construction of an alternate sediment control around the perimeter of each stockpile. Detailed calculations for each are found in Appendix 7-7.

732.220 MSHA Requirements

The sedimentation ponds within the SCA Permit Area comply with the MSHA requirements given under R645-301-513.100 and 513.200.

732.300 Diversions

An extensive network of runoff collector ditches has been constructed within the permit area. A layout of these facilities is shown on Plate 7-1. Individual diversion dimensions can be found in Appendix 7-3. The ditches will be maintained to comply with the requirements of this regulation.

There are a few disturbed areas within the permit area that do not report to a sediment pond. Alternate Sediment controls provide water treatment as described in Appendix 7-7.

732.400 Road Drainage

All roads will be constructed, maintained and reconstructed to comply with section 742.400

732.410 Alteration and Relocation of Natural Drainageways

No alterations to existing natural drainageways are planned for the operations in the SCA Permit Area.

732.420 Inlet Protection

Measures to be taken to protect the inlet end of ditch relief culverts (when required) within the SCA Permit Area may include revegetation, installation of riprap, or a drop box inlet. Flows applicable to runoff control ditches are generally small and inlet protection is not required to protect against erosion. If it is found that significant erosion does occur at the inlet to a ditch or culvert, the items listed above will be implemented as appropriate. Details for inlet and outlet protection are given in Chapter Five.

733 IMPOUNDMENTS

There are no additional impoundments proposed for the SCA Permit Area. If the need for an additional impoundment is observed, it will be designed and certified according to the requirements of these regulations, and the other regulations within the State of Utah Coal Mining Rules. The plans and certification will then be submitted to DOGM for approval.

734 DISCHARGE STRUCTURES

See Section 744.

735 DISPOSAL OF EXCESS SPOIL

See Chapter Nine, Sections 9.6 through 9.7 and Appendices 9-2 and 9-5.

736 DISPOSAL OF COAL MINE WASTE

See Chapter Nine, Sections 9.6 through 9.7 and Appendices 9-2 and 9-5.

737 NONCOAL MINE WASTE

Non-coal mine waste will be disposed of as discussed further in Chapter Nine, Section 9.6.

738 CASING AND SEALING OF WELLS

For reasons previously discussed, there are no additional groundwater monitoring wells which need casing and sealing during the operations or reclamation activities.

740 DESIGN CRITERIA AND PLANS

741 GENERAL REQUIREMENTS

Site specific plans used for the design and control of surface drainage are discussed in the following sections.

742 SEDIMENT CONTROL MEASURES

See Section 732 for detailed designs of all sediment control structures. The major runoff and sediment control measures in the SCA Permit Area include numerous diversion ditches and several impoundments. Some Alternate Sediment Controls are in-place and maintained to reduce the contribution of sediment to

receiving streams, from areas which do not report to an approved impoundment. If additional siltation structures are required, SCA will request approval from the Division prior to installation.

742.220 Sedimentation Ponds

Inspection

All sedimentation ponds will be inspected a minimum of four (4) times per year for structural weakness, erosion, proper function, sediment levels and other hazardous conditions. A written record of findings will be maintained at the SCA cogeneration facility for inspection. Reports of adverse embankment conditions including erosion, structural weakness or other hazardous conditions will be submitted to DOGM within thirty (30) days of the inspection. Hazardous conditions will be reported directly to DOGM immediately after the finding. See the inspection schedule prepared in compliance with R645-301-514.

Sediment Disposal

Sediments removed from the ponds will be disposed in the Excess Spoil Disposal Areas, placed on the refuse pile, used as a borrow material, or processed with material burned in the cogeneration plant. If the material is to be used as a borrow material, the material will be tested. SCA will contact DOGM to receive approval of the location and the amount of material to be used.

MSHA REQUIREMENTS

No impoundments within the SCA Permit Area meet or exceed the size criteria of 30 CFR 77-216(a). ~~The East Slurry Cell is used as refuse storage and as a surface runoff impoundment. The East Slurry Cell meets or exceeds the size criteria of 30 CFR 77-216(a) of the Mine Safety and Health Administration and has an MSHA ID number. The impoundments will comply with the requirements of this regulation. The MSHA Approved Program for Impoundment Inspections is in Appendix 5-8.~~

742.230 thru 742.240 Other Treatment Facilities

Sediment from most of the disturbed area within the Permit is controlled by the collector ditches and sedimentation ponds. SCA is committed to designing, constructing and maintaining appropriate sediment control measures using the best technology currently available to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area.

Alternate Sediment Controls (ASC), installed at certain locations throughout the permit area are used to reduce the contribution of sediment to the receiving streams. These have been installed and are maintained in accordance with the performance standards outlined in Chapter 5. Plate 7-20 shows details of various ASC's which are being used at locations shown on Plate 7-1. It is intended that as site conditions dictate, SCA may switch between different types of ASC's shown on Plate 7-20 to achieve an efficient and cost effective treatment.

TABLE 8-1

DETERMINATION OF BOND AMOUNT

DETERMINATION OF BOND AMOUNT - Summary

ITEM	QUANTITY	RATE	COST
Total Crusher Demolition Culvert Removal & Riprap			$ 130,042
Total Backfill, Grading and support			$ 767,798
Total Revegetation and Erosion Control			$ 299,332
Total (Direct Costs)			**$ 1,197,172**
Mobilization and Demobilization	10%		$ 119,717
Contingency	5%		$ 59,859
Engineering Redesign	2.5%		$ 29,929
Main Office Expense	6.8%		$ 81,408
Project Management Fee	2.5%		$ 29,929
Total (Indirect Costs)	**26.8%**		**$ 320,842**
Total (Direct and Indirect Costs - 2010 dollars)			**$ 1,518,014**
Escalation 5 years to Mid Term 2015	5	0.50%	$ 38,332
Total Reclamation Costs (Escalated)			$ 1,556,346
Bond Amount Required (Rounded to the nearest $1,000)			**$ 1,556,000**

DETERMINATION OF BOND AMOUNT - Revegetation

ITEM	QUANTITY	UNIT COST	COST
Atriplex Grass Revegetation Areas			
Seed Material Costs (Granite Seed Sept 2010)	53.3 Acres	$ 359.00	$ 19,135
Tractor Spreader (equip & labor) B-66 Reveg 004 + 10%	2,322 MSF	$ 11.55	$ 26,816
Fertilizer hydrospread M029351000180 + 10%	2,322 MSF	$ 4.18	$ 9,705
Pinyon Juniper Sagebrush Revegetation Areas			
Seed Material Costs (Granite Seed Sept 2010)	142.6 Acres	$ 566.70	$ 80,811
Tractor Spreader (equip & labor) B-66 Reveg 004 + 10%	6,212 MSF	$ 11.55	$ 71,745
Fertilizer hydrospread M029351000180 + 10%	6,212 MSF	$ 4.18	$ 25,965
Hydrophytic Revegetation Areas			
Seed Material Costs (Granite Seed Sept 2010)	0.6 Acres	$ 279.90	$ 168
Tractor Spreader (equip & labor) B-66 Reveg 004 + 10%	26 MSF	$ 11.55	$ 302
Fertilizer hydrospread M029351000180 + 10%	26 MSF	$ 4.18	$ 109
Subtotal Revegetation	196.5 Acres		$ 234,756
Reseeding 25%	49.1 Acres		$ 58,689
Plastic netting (Means 312513100100)	5,000 square yards	$ 1.13	$ 5,650
Silt fences (Means 312513101000)	300 Linear Feet	$ 0.79	$ 237
Total Erosion Control			$ 5,887
Total Revegetation and Erosion Control			$ 299,332

DETERMINATION OF BOND AMOUNT - Backfill and Grading

ITEM	QUANTITY	PRODUCTION RATE	HOURS REQUIRED	UNIT COST	COST
Backfilling and Grading					
General site grading: High walls, Refuse Cleanup and Drainage needs					
D-10 R Dozer	200,000 Cubic Yards	1,800 cy/hr	111	$ 320.00	$ 35,556
Disturbed area covered with refuse (4' borrow)	78.2 Acres				
C-631 E Scraper	504,457 Cubic Yards	375 cy/hr	1345	$ 240.00	$ 322,853
D-10 R Dozer (one dozer to assist loading four scrapers)			336	$ 320.00	$ 107,618
Disturbed area w/ 2' existing cover over refuse (2' additional borrow)	13.7 Acres				
C-631 E Scraper	44,302 Cubic Yards	375 cy/hr	118	$ 240.00	$ 28,353
D-10 R Dozer (one dozer to assist loading four scrapers)			30	$ 320.00	$ 9,451
D-10 R Dozer (spreading on hillside)	44,302 Cubic Yards	375 cy/hr	118	$ 320.00	$ 37,804
Disturbed area contaminated by refuse (1.5 ' borrow)	44.4 Acres				
C-631 E Scraper	107,424 Cubic Yards	375 cy/hr	286	$ 240.00	$ 68,751
D-10 R Dozer (one dozer to assist loading four scrapers)			72	$ 320.00	$ 22,917
D-10 R Dozer (minor spreading in some hillside areas - 25%)	26,856 Cubic Yards	700 cy/hr	38	$ 320.00	$ 12,277
Distribution of salvaged topsoil	8.7 Acres				
D-10 R Dozer	7,928 Cubic Yards	375 cy/hr	21	$ 320.00	$ 6,765
Scarification (average 18" depth)	196 Acres				
D-10 R Dozer with multishank ripper	474,320 Cubic Yards	3,000 cy/hr	158	$ 320.00	$ 50,594
Construction Management					
Water Truck	3.5 Months	87 hr/mo	305	$ 100.00	$ 30,450
Foreman and 4x4 pickup - Nielson	3.5 Months	174 hr/mo	609	$ 56.50	$ 34,409
Total Construction Management					**$ 64,859**

Total Backfill, Grading and support					**$ 767,798**

DETERMINATION OF BOND AMOUNT - Const Mgt, Demolition, Erosion Control

ITEM	QUANTITY	PRODUCTION RATE	HOURS REQUIRE	UNIT COST	COST
Crusher Facilities, Culverts and Riprap Channels					
Demolition of crusher facilities					
Concrete - Crush and bury on site	50 Cubic Yards			$ 24.02	$ 1,201
Steel - Disassemble and send for scrap	100 Tons			$ 33.00	$ 3,300
Culvert excavation, removal and disposal					
Track Excavator 325 CL (av 1 cy ex per 3 ft culvert)	217 Cubic Yards	15 yd/hr	14.4	$ 135.00	$ 1,950
Disposal	650 LF			$ 3.30	$ 2,145
Drainage Channel Reconstruction					
Major Channels with riprap and filter bed	1,700 Linear Feet	1.76 cy/lf			
Material cost (means 313713100100) +10%	2,992 cubic yards			$ 27.06	$ 80,964
Equipment and Labor	2,992 cubic yards	180 yd/hr	16.6	$ 135.00	$ 2,244
Minor Channels requiring riprap	2,500 Linear Feet	0.55 cy/lf			
Material cost (means 313713100100) +10%	1,375 cubic yards			$ 27.06	$ 37,208
Equipment and Labor	1,375 cubic yards	180 yd/hr	7.6	$ 135.00	$ 1,031
Total Crusher Demolition Culvert Removal & Riprap					**$ 130,042**

CHAPTER NINE
9.1 MINING PLANS

The refuse disposal area, previously created by the Sunnyside Coal Company (SCC), has been acquired by Sunnyside Cogeneration Associates (SCA) to serve as a long-term supply of waste fuel for its coal mine waste-to-energy facility, located adjacent to the SCA Permit Area. SCA's alternative energy project has been approved by the Federal Energy Regulatory Commission as a Qualifying Facility, based on the usage of coal mine waste as fuel in its fluidized-bed combustion boiler. SCA will use "active waste" from off-site processing plants/refuse piles, "accumulated waste" from refuse piles, and other alternate fuels as sources of waste fuel for the facility. SCA's fueling plan will require excavation of coal mine waste from the existing refuse pile, which began as early as January 1993.

Based on SCA's contract for the sale of electricity to Utah Power and Light, handling coal mine waste to serve as an alternative energy fuel will be a consistent and continuous process. Coal mine waste that continues to be generated by off-site preparation plants and other coal materials discussed in this chapter will also be factored into SCA's fueling strategy, which can allow direct acceptance of coal mine waste at the facility, or temporary placement within the approved storage areas or the refuse disposal area prior to utilization.

SCA will excavate coal mine waste from the refuse disposal area based on sampling and analyses and a materials handling plan which will be periodically updated by SCA. Excavation of the coal mine waste will be considerate of material quality, pile and embankment stability, and mine operation. Over the life of SCA's facility, nearly all of the coal mine waste will be burned to generate electricity. Final reclamation of the refuse pile will be accomplished after all of the coal mine waste is either burned as a fuel, or repositioned within the refuse disposal area for final disposal, if determined to be unacceptable fuel material (i.e., ashes, rock, soil, etc.).

Plate 9-4 and 9-7 present an overall projection for the sequence of mining events. The majority of mining activity is expected to be concentrated within the areas identified in the mine sequencing maps. However, in order to obtain the proper blending of material which will be suitable for use in the adjacent cogeneration plant, excavation of coal mine waste may occur in any of the existing disturbed areas of the SCA Permit site. Mining activities will regularly occur in the storage areas and in the slurry handling areas throughout the life of the mine. Information used to compile these mine sequencing maps was gathered mostly from the John T. Boyd Reports found in Appendix 9-1 and 9-3. Appendix 9-1 presents the John T. Boyd fuel study. Data, including boring logs, to substantiate the conclusions of the Mine Plan are included in Appendix 9-3.

9.2 DESCRIPTION OF PRESENT DISTURBANCE

Presently approximately 8057% of the SCA Permit Area is disturbed. The disturbances have been caused from 1) coal mine waste disposal, 2) roads, and 3) sedimentation ponds and ditches. The majority of the impacted land was disturbed prior to the present resource protection laws. The future activities of the SCA Cogeneration facilities are expected to cause little or no new disturbances to vegetated areas as the permit activities will be located mainly in areas that have been disturbed in the past.

All facilities are shown on Plate 5-1. Plate 3-1 outlines the areas of pre- and post-law disturbances.

9.3 RECLAMATION ACCOMPLISHED TO DATE

Interim reclamation was conducted in the fall of 1992 on the faces of lifts one through four of the coarse refuse pile. Approximately two feet of borrow material was placed on these areas to control fires that had been burning within the coarse refuse pile. SCC conducted this project in cooperation with DOGM. Interim seeding on lifts three and four was accomplished by SCA in the spring of 1994.

SCC accomplished interim reclamation prior to 1993 on the east embankment of the East Slurry Cell, on the north embankment of the West Slurry Cell, and on a small portion of the south embankment of the West Slurry Cell. Final reclamation is anticipated to be accomplished by SCA in accordance with the schedule and design details specified in this permit.

Final reclamation work was accomplished by SCA during 1994 on the Old Coarse Refuse Road near the south end of the permit area. This work was completed in accordance with a plan approved by DOGM. Phase ~~1~~3 bond release has been granted by the Division for this work and portions of the reclaimed area have been removed from the permit area.

Interim reclamation was accomplished by SCA during 1994 on the southwest hill next to the refuse pile where three culverts were installed. Final reclamation is anticipated to be accomplished by SCA in accordance with the schedule and design details specified in this permit.

Interim reclamation was accomplished by SCA during 1995 on the South Embankment of the East Slurry Cell. Reseeding took place during the regular seeding window of that year. Final reclamation is anticipated to be accomplished by SCA in accordance with the schedule and design details specified in this permit.

9.4 GENERAL RECLAMATION OBJECTIVES

The reclamation activities proposed in this chapter are intended to meet the following specific objectives:

- Regrading of the areas within the coarse refuse pile~~, slurry cells~~ and other disturbances to achieve a stable, post-mining contour which will be compatible with the surrounding area, similar to the original pre-mining contour, free-draining, and conducive to revegetation.

- Restoration of the natural drainage pattern through the disturbed area to the extent practicable while maintaining appropriate sediment controls at the periphery of the disturbed areas.

- Covering areas that have been cleaned of refuse or slurry with the required depth of topsoil or borrow material to allow revegetation of these surfaces.

- Reseeding the regraded surfaces with a species mix designed to re-establish the surrounding native vegetation on the reclaimed areas and provide for wildlife habitat.

- Monitor and maintain the reclaimed property until the reclamation success standards are achieved and the bond is released.

9.5 AREAS TO BE RECLAIMED AND PLANNED RECLAMATION

The area of reclamation and reclamation sequencing is shown in Plate 10-3.

During the mining plan phase of the project the coarse refuse pile ~~and East Slurry Cell~~ will be excavated and during reclamation the site will be covered with borrow material, recontoured and revegetated. The existing sediment ponds will be kept in-place until the final reclamation phase to control runoff from the area.

9.6 EXCAVATION AND DISPOSAL OF COAL MINE MATERIAL

SCA's activities will include excavation and handling of non-coal mine waste, coal mine waste, and redisposal of non-combustible materials within the SCA Permit Area. Temporary storage of non-coal mine waste (including, but is not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber, and other ~~combustible~~ materials generated during mining activities) will be in the area just west of the Pasture Pond, between the Pasture Pond and Industrial Borrow Area 1 (See Plate 5-1). The site is approximately 1.1 acres and will be used as a temporary storage facility for material not suitable (non-coal mine waste) for the Excess Spoil Disposal Area sites produced from within the SCA Permit Area Temporary storage of non-coal mine wastes will be conducted to ensure that leachate and surface runoff do not degrade surface or groundwater, that fires are prevented, and that the area remains stable and suitable for reclamation and revegetation compatible with the natural surroundings. ~~It should be noted that accommodations have NOT been made for the disposal of non-coal mine waste that is produced from the Sunnyside mines. It is Sunnyside Coal Company's (SCC) responsibility to dispose of all non-coal mine waste produced from their facility outside of the SCA Permit Boundary. SCC has NOT been authorized to store or dispose of non-coal mine waste within the SCA Permit Boundary.~~

Final disposal of non-coal mine waste will be in an appropriate local, State-approved solid waste landfill. All non-coal mine waste will be disposed of in a timely manner as it is accumulated. It is not foreseen that there will be a significant amount of non-coal mine waste that will require disposal. At no time shall any non-coal mine waste be deposited in a refuse pile or impounding structure.

The mine sequencing maps 9-4 and 9-7 project the excavation of coal mine waste within the SCA Permit Area. These are projections and may need to be revised with each permit renewal if existing conditions within the refuse pile are discovered to be ~~significantly~~ different than expected. The annual reports submitted to DOGM should be adequate to keep the Division advised concerning the mining progress.

The majority of mining excavation is expected to be concentrated within the areas identified on the mine sequencing maps. However, mining activities may occur within any of the existing disturbed areas of the SCA Permit site and should be expected to occur regularly in the storage areas and the slurry handling areas.

Mine plan delivery parameters are as outlined in Table 9-1.

TABLE 9-1
MINE PLAN DELIVERY PARAMETERS

	TONS		
Mine Plan Deliveries	Coarse	Fines	Total
Average annual fuel requirement	310,102	99,898	410,000
Average daily basis (240 days)	1,292	416	1,708
Average hourly basis (1,920 hours)	161.5	52	213.5
Number of trips per day (56.5 tons)	23	7	30
Trips per operating hour	3	1	4

The equipment typically used for loading and hauling services are one Caterpillar 980C type front-end loader with a modified 7.0 cubic yard bucket and one hauler with dual trailer rated at 60 tons capacity. Based on one 10-hour shift and a 5-day workweek, this equipment allocation is more than adequate to consistently deliver the amount of waste coal fuel required by the cogeneration facility.

9.6.1 Coarse Refuse

There are four locations that will be utilized specifically for the temporary storage of coarse and fine refuse. These areas are shown on Plate 5-1 and on Plate 9-7. Specifically section 9.6.3, includes further discussion concerning the practicality of utilizing the temporary storage areas.

9.6.2 Fine Refuse

One of the prime objectives of the mine plan is to minimize material handling. Many constraints may be encountered during the mining of coarse and fine refuse. SCA will adjust mining activities as needed to meet the operational requirements of providing the proper mixture of fine and coarse refuse to the cogeneration plant.

The sequencing as planned exposes coarse refuse ahead of requirement and does not create excessive high wall height between one operating area and another.

9.6.3 Temporary Storage Areas

Four temporary storage areas exist within the Permit Area for blending, mixing, handling, and storage of coarse refuse and fine refuse. The reasons for these storage areas are: a place to temporarily store coarse

refuse and fine refuse being brought to the SCA Permit Area, and to create a smoother, more efficient operating procedure for material prior to entering the crushing units.

These areas will be used for blending, mixing, handling and storage of the various materials to be used as fuel in the power plant.

Storage Area 1

Storage Area One measures 2.9 acres or 126,324 square feet. The storage capacity of each 4-foot lift is about 20,200 tons as follows:

$$\frac{126{,}324\ ft^2 \times 4ft \times 80lbs/\ ft^3}{2000lbs/ton} = 20{,}212\ tons$$

The surface of Storage Area One slopes towards the southwest at about 3% grade. The drainage direction is southwest. There is a ditch that runs parallel to the southern boundary of Storage Area One that drains to the existing 24" culvert at the south end of the New Access Road then to the Pasture Sediment Pond. The drainage locations are shown on Plate ~~9-27-1~~.

Approximately 1.95 acres of Storage Area One was undisturbed and has been reclassified as "post-law disturbed" (see Plate 3-1) due to the storage of coarse refuse material in this area.

~~Topsoil removal will be consistent with approved methods outlined in Section 9.8. Topsoil from Storage Area One will be placed adjacent to the northeastern boundary of the SCA Permit Boundary as shown on Plate 5-1.~~

The Lower Haul Road (a primary road) provides access into Storage Areas One and Two. ~~Minor alterations to both the Lower and Upper Haul Roads provided access into and out of Storage Areas One and Two. Both of these roads have been designated "Primary Roads". The east end of the Lower and Upper Haul Roads was slightly altered to allow easy access into and out of Storage Areas One and Two. The west intersection of Storage Area Two and the Upper Haul Road will also be changed to allow access into Storage Area Two from the west side. The proposed changes to the two roads are minor.~~

Topsoil was handled according to DOGM guidelines and was consistent with the plans outlined in the approved SCA Permit Document (Section 9.8). Vegetation was removed and topsoil was stripped and stockpiled. Topsoil piles (See Plate 5-1) are labeled with visible signs and measures will be taken to protect the topsoil from further disturbance. Topsoil will be used during final reclamation and therefore, will not be respread over the roadway embankment.

Trees and large shrubs were removed prior to topsoil removal. Small shrubs, grasses and forbs were collected with the topsoil material. Coal mine waste was separated from this material and a Soil Tabulation Chart was completed for the topsoil which was removed. Topsoil was stockpiled near the northeast boundary of Storage Area One as shown on Plates 5-1 and 5-5. The topsoil storage pile was contoured to minimize soil loss and seeded with the interim seed mixture. Fertilizer was not required on the stockpiles. A small berm was~~will be~~ constructed at the base of the new topsoil pile to prevent erosion until vegetation becomes established.

Three grab samples have been taken in Storage Area One (sample locations are shown on Plate 5-1) and testing has been completed. The samples were tested according to Table 1 of the DOGM's *Guidelines for Management of Topsoil and Overburden*. Based on DOGM's overburden evaluation for vegetative root zone, the material in Storage Area One is rated 'Good'. These results are included in Appendix 9-4.

Storage Area 2

Storage Area Two measures approximately 3.1 acres or 135,036 square feet. An ~~active~~ industrial waste dump was located~~occurs~~ in this area as a depression measuring 25,000 square feet and averaging 8 feet deep. To prepare Storage Area Two, the floor of the Industrial Waste Dump ~~will~~ was~~be~~ leveled. Utah Department of Environmental Quality (UDEQ) regulations were~~will be~~ followed to ensure proper closure of the dump site. The following section outlines procedures that were~~will be~~ followed to ensure compliance.

According to R315-303-2(3) of the UDEQ's regulations, "Any landfill that received waste after October 9, 1991 but stopped receiving waste before October 9, 1993 is exempt from all requirements of this section except for final cover." The Industrial Waste Dump located on SCA's property falls under this requirement. The closure of the site entailed complying with the requirements listed below:

1) At least 18" of compacted soil with a permeability of 1 x 10^{-5} cm/sec or less or equivalent was ~~will be~~ placed upon the final lifts. Artificial liners may replace compacted soil covers provided that a minimum of either 20 mils reinforced or 40 mils non-reinforced thickness is used and is covered with eighteen inches of natural subsoil present in the unit.

2) The grade of the surface slopes is~~will~~ not ~~be~~ less than 2%, nor the grade of side slopes more than 33%.

An addition to the above requirements, SCA exterminated all rats or other vermin from the site, extinguished all fires, covered all solid wastes with consolidated, compacted material at least 18 inches deep, graded to provide proper drainage (see discussion below), and will reclaim the site upon final reclamation of the entire SCA Permit Area. These requirements are outlined under R315-304-8 of the UDEQ Division of Solid and Hazardous Waste regulations.

The natural drainage of the site is toward the east at approximately 2%. Storage Area Two was graded to allow drainage toward the northeast at approximately 2% grade (see Plate 9-2). An 18-inch culvert was installed at the northeast corner of the site which allows drainage into the Pasture Sediment Pond. Hydrologic calculations are included in Appendix 7-3. In addition, a 12" high berm was constructed around the southern perimeter of Storage Area Two to prevent runoff from the West Slurry Cell from entering the storage area.

Storage Area 3

Storage Area Three (approximately 7.5 acres) will be used primarily when additional storage is required if Areas One and Two cannot handle the amount of coarse refuse and fine refuse being generated. ~~Fine refuse removed from the active Slurry Ponds numbers One and Two is currently stored within this area. The fine refuse (approximately 15,000 tons) occupies 25,000 square feet of surface (of the total 275,000 square feet available for coarse refuse storage) in two separate areas.~~ The coarse refuse storage capacity of each lift is approximately 44,000 tons.

The surface slopes toward the west at about 6% average grade. Drainage direction is west-southwest ~~to the ditch which transports slurry to the East Slurry Cell (when in use)~~. Additional grading is not necessary for this area.

Storage Area 4

Storage Area Four is located inside the loop of the New Access Road. The area is approximately 1.5 acres and runoff from this area is diverted to the Pasture Sediment Pond. At times, coarse refuse from the existing coarse refuse pile is stored in the center of the New Access Road loop prior to being placed on the conveyor. This area is also utilized for temporary storage of High Ash Fuel Reject and/or ROM coal acquired from outside sources.

Maintenance

Maintenance of the storage areas will consist of providing general maintenance and inspections of the surrounding structures, drainages, culverts, and roads.

Water or other dust control measures will be applied as necessary to reduce dust. General road maintenance procedures will be practiced and inspections will be done as necessary. Inspections will consist of: erosion control, repair of structures and drainage systems, removal of debris in culverts and replacement of road surfacing material as needed.

Reclamation Plans

Reclamation plans will not deviate from those outlined in Chapters 9 and 10. Approximately two acres of Storage Area One, which had minimal mining related disturbance in the past, were disturbed as a result of the initiation of the temporary storage areas. Reclamation activities for this area will follow procedures outlined in section 9.9.1 GENERAL REVEGETATION PROCEDURES.

9.6.4 General Refuse Handling Procedures

Currently, SCA is utilizing coarse refuse from the coarse refuse pile for use as fuel in the cogeneration facility. Prior to the material being used as fuel, whether it be run of mine ("ROM") coal or waste coal, it must be run through the receiving hopper and sized accordingly to meet operational specifications of the cogeneration facility. Nonetheless, since the crushing facilities are designed for softer coal type materials, there are instances when the material from the coarse refuse pile does not meet sizing requirements and is rejected by the crushing unit, i.e. cannot be sized correctly. This material is often rejected due to a high rock content and a low coal content.

The quality of the reject material will be determined. The final use or disposal of the reject material will be dependent on the fuel potential of the material and the potential for alternate acceptable uses.

The stockpiling of the reject material will be in accordance with applicable DOGM regulations. When placed in the temporary storage area or back on the coarse refuse pile, the high fuel potential material will be placed in 4-foot lifts, but will not be compacted. Compaction will not be accomplished for the area being mined due to the fact that the pile is continually altered due to excavation activities.

The low fuel potential material that is placed in an Excess Spoil Disposal Area will be in accordance with the approved plan and applicable regulations under R645-301-535. Slopes in both areas will be at a maximum of 2.5:1 unless otherwise approved by DOGM. Drainage of the areas will follow the existing drainage of the area and will be contained in an existing sediment pond.

The New Access Road, located adjacent to the cogeneration facility, plays a vital role in the transporting of material from the SCA Permit Site to the Cogeneration Facility. The New Access Road, the hopper, and the crushing/screening facilities are within the boundaries of the SCA Permit Area. However, the conveyor to the Cogeneration facility's storage silos is not within the SCA Permit Area. A detailed description of the waste coal handling system can be found in Chapter Five, section 527. SCA transports coarse refuse from the coarse refuse pile and/or Storage Areas to the cogeneration facility via the New Access Road. The coarse refuse is then placed on the conveyor system and screened before entering the storage silos. The material that is rejected during the screening process can be dumped into the Waste Coal Storage Area (see Plate 5-1). After it has been stored it is taken back to the New Access Road and is either temporarily stored in one of the storage areas, or immediately placed back on the conveyor to be screened and used in the cogeneration facility. At times, the coarse refuse from the existing coarse refuse pile is stored in one of the temporary storage areas prior to being placed on the conveyor.

The New Access Road was constructed by SCA specifically for these operations. The design of the road was approved by DOGM prior to construction and DOGM approved the road once it was built. Drainage from this road is diverted to the Pasture Sediment Pond (see Plate 7-1A). Hydrologic calculations for the Pasture Pond are included in Chapter Seven (Appendix 7-3).

There are instances when SCA will purchase and/or transport material that originates off-site (i.e. from other coal mines) to the SCA Permit Area. For example, SCA may need to purchase approximately six to seven thousand tons of ROM coal from outside sources each year. Also, coal mine waste from other refuse facilities (from active or AML sites) may be transported to the SCA facility. SCA has acquired rights to refuse material from the Star Point Mine. Transport, mixing, and utilization of this other fuel material is a regular part of the mining operation at Sunnyside. Prior to being utilized at the cogeneration facility, this material may be blended with the existing coarse refuse in order to achieve the most effective blend of material for the cogeneration facility. Blending of the material will be accomplished by placing it in one of the Storage Areas (One, Two, Three or Four) or on the existing coarse refuse pile.

In 1993, SCA acquired the right to use approximately 24 railroad cars of ROM coal (approximately 2,400 tons) that was recovered from a train wreck. SCA utilized this coal in the cogeneration facility. SCA followed the plan outlined above by first storing the material in one of the storage areas or on the coarse refuse pile. The material was then fed through the waste coal receiving hopper and utilized in the SCA facility. In the event that this material had contained spoil material, the spoil material would have been separated from the higher quality material and placed in the Excess Spoil Disposal Area. In a worst case scenario, spoil may have comprised approximately 10% or 240 tons of the total quantity.

Stockpiling of the excess spoil material in the Excess Spoil Disposal Areas will be in accordance with applicable DOGM regulations. All material will be transported and placed in a controlled manner in horizontal lifts not exceeding four feet in thickness. If necessary, the pile will be compacted to ensure mass stability. The fill material will be placed to maintain a minimum long-term static safety factor of 1.5. Periodic structural stability inspections will be accomplished to monitor the stability of the pile.

- Coal mine waste, acid-forming, toxic-forming, or combustible material will be covered with a minimum of four feet of non-acid-forming, non-toxic-forming, and non-combustible material
- Regular inspections as required in R645-301-514.

EXCESS SPOIL DISPOSAL AREA #2

The northeast portion of the Permit Area ~~is currently~~was formerly occupied by the Slurry Ponds #1 and #2 and the Clear Water Pond. This area has been approved as a permanent disposal area for excess spoil and coal mine waste. It has been designed with a capacity of approximately 217,000 cubic yards (See Appendix 9-7 and drawings 9-8 A-D).

This area is ideal for its proposed use because it is already a large incised hole in the existing disturbed area. Filling these holes will be the best attempt to return the area to the approximate original contours. This site is designed with a very mild outslope for positive drainage and is located in an area without high groundwater or major surface runoff flows.

Reclamation of this site is bonded for the costs of four feet of cover. At the completion of construction of this disposal area, SCA will perform reclamation with less than four feet in an attempt to demonstrate that successful reclamation can be accomplished with a lesser amount of borrow material cover. In the event that reclamation is not successful, the additional cover will be placed to bring it up to a total of four feet and then reseed the site.

CAPACITY of the EXCESS SPOIL DISPOSAL AREAS

The design of the Excess-Spoil Disposal Area #1 has a capacity of approximately 467,800 cubic yards most of which is still available. It should be noted that the area might be compatible to allow for further expansion of the excess spoil disposal area to the east at a later date to handle additional material if necessary.

The Excess Spoil Disposal Area #2 has a capacity of approximately 217,000 cubic yards. ~~As of the 2002 Permit Renewal, the estimated capacity remaining was approximately 150,000 cubic yards.~~ Although this site is available for disposal for all qualified materials, it is anticipated that it will principally be used for disposal of low fuel rejects. These two Excess Spoil Disposal Areas have ample capacity to accept the material quantities projected during the Permit Term ~~(100,000 yards rejects, 30,000 yards spoil materials)~~.

The sites described below in "Additional Locations Considered for Excess Spoil Disposal Areas" are available to provide additional capacity for disposal of excess spoil materials in the event that excavation of the existing refuse pile encounters quantities of material beyond what is initially expected. These other areas may also provide SCA with the opportunity to selectively place different types of spoil material into different locations to the extent possible within the capacities available at the time the materials are disposed.

RECLAMATION of EXCESS SPOIL DISPOSAL AREAS

Reclamation of the Excess Spoil Disposal Areas will be in accordance with applicable DOGM regulations. The excess spoil and coal mine waste obtained over the life of SCA operations will be placed in a controlled manner to ensure that the final disposal facility will be suitable for reclamation and revegetation

Prior to seeding, the topsoil and other regraded surfaces will be disced lightly, or be scarified along the contour if a crust has developed since final grading or other soil preparation activities. Otherwise, no special soil preparation will be necessary.

9.8.5 Amendments

It is ~~expected~~ possible that the applied borrow material may require fertilizer amendments at the time of reclamation. Extensive testing of the proposed borrow areas has occurred and is described in Chapter 2 and corresponding appendices. Information from these previous studies together with some random soil testing (pH, Ec, SAR and macronutrients N, P, K) at the time of reclamation will be conducted according to DOGM Topsoil Guidelines to make a final determination concerning appropriate fertilizer rates. SCA will work with DOGM to ensure that the redistributed soils are analyzed according to DOGM Guidelines and that the tests are performed by an approved laboratory. In general, soil amendments (if needed) will be applied during the fall concurrent with reseeding operations to maximize plant response.

9.9 REVEGETATION

The objective of the post-mining revegetation program is to restore the surface-disturbed area to a land use capability similar to that which existed prior to mining. The initial reclamation objectives will be to stabilize the soils and to restore the disturbed area to approximate original topographic conditions. Ultimately, the disturbed areas will be returned to their pre-mining use with watersheds in their approximate pre-mining character. In general, the long-term appearance and usefulness of the reclaimed permit area will be similar to that encountered prior to mining and also to that found in the adjacent areas that remain undisturbed by mining and related activities.

9.9.1 General Revegetation Procedures

All areas that are currently disturbed are shown on Plate 3-1, as well as those areas that will be disturbed as a result of the Mining Plan or the Reclamation Plan activities will be reclaimed according to the procedures discussed in this section. Areas of contemporaneous reclamation which will occur during the operations phase are outlined in Plate 10-3. A Final Reclamation Plan is presented in Plate 10-1 through 10-7. The general procedures outlined below will be used for all reclaimed sites. Additional details on these procedures can be found throughout this chapter and in chapter 10.

- Sub-grade shall be cleaned of waste material, scarified and pulverized before covering with topsoil or borrow material.
- Topsoil or borrow material will be spread unevenly over all areas to approximate depths as described in the final reclamation plan.
- The final grade will be blended into the existing grade with a natural finish.
- The finished grades will be left in a roughened state. On slopes less steep than 2:1, all efforts will be made during grading to conduct the last pass in the direction of the contour rather than perpendicular to the contour. The purpose of this effort will be to leave small berms to break up the slope.

- Fertilizer (if needed) will be spread just prior to seeding. The fertilizer may be spread by any method that will give an even distribution. (SCA will consult with DOGM in determining the extent to which fertilizers may be needed)

- Areas with slopes greater than 2:1 shall be scarified to a depth of 6-inches prior to seeding.

- Final reclamation seeding must be accomplished between October 1st and November 30. All efforts will be made to plan and schedule reclamation work such that it can be completed in a time frame that allows seeding to be accomplished during this approved seeding window. If seeding is not finished during this time frame then all remaining seeding and any related reclamation work will be suspended until the following year. Areas which cannot be seeded during the seeding window will be stabilized to reduce erosion. Some acceptable methods of stabilization include: seeding with an annual grain, mulching, or netting until the seeding window has opened. However, seeding with an annual grain will not take place later in the year than September 15 for areas which are to be seeded with a permanent seed mixture that fall due to the potential competition the annual grain may have. Interim seeding may be conducted at SCA's discretion during other times during the year (such as early spring) that currently appear to show promise of success.

- For areas to be hydro-seeded the water and 15% of the wood fiber mulch and 50% of the tackifier will be mixed in the hydroseeder. The slurry will then be mixed with water at a rate of 13,000 gallons per acre and the seed will be added to the slurry. The seed/slurry mixture will be applied to form an even cover within 30 minutes of the seed being added to the slurry. Application will begin at the top of the slope and work downward. The remaining mulch and tackifier will be applied immediately following initial seeding.

- For slopes greater than 2:1, seed may be broadcast evenly over the prepared slopes by means of a hand-held seeder. Broadcasting will not be done during windy conditions or when the soil is saturated.

- All areas which are seeded will be raked or chained to provide adequate seed to soil contact.

- On slopes steeper than 2H:1V, additional erosion control measures (such as excelsior type mats) will be implemented to cover the seed bed surface and protect the barren soil surface from wind and water erosion, to increase revegetation success to meet the post-mining land use. If methods of erosion control which are more economically viable than matting are generally accepted by revegetation specialists as effective for slopes similar to what is being reclaimed, SCA will present the option to DOGM for review prior to beginning revegetation work.

- Shrub plantings will be used on a few sites to augment the shrub portion of the existing plant community and to blend in man-made features with the natural terrain. The shrub stock will be pinyon pine and juniper tublings. The tublings will be grouped and not evenly placed at a density of 200 shrubs per acre. The planting site will be saturated with water as the initial irrigation. The planting site and rooting area will be hand-cleared of all vegetative growth to reduce competition from established vegetation. SCA commits to creating six (6) areas consisting of approximately 1000 shrub plantings each as shown on Plate 10-7. These shrub plantings will occur at the time that final reclamation work is performed in each designated area. The shrub plantings are being created for the purpose of establishing areas of cover for wildlife habitat.

9.10 WATER TREATMENT

During the mining period the existing sediment control structures and diversion ditches will be used. This would allow the site to meet the regulatory effluent requirements and to ensure that no significant environmental damage would be caused by the operations.

9.10.1 Diversions

Plans for diversion ditches within the SCA Permit Area are discussed in Chapter Seven, Hydrology. Included in this chapter are the criteria and the designs of the ditches, culverts and sedimentation ponds required to maintain water quality in accordance with the prevailing regulations.

9.10.2 Sediment Control

The impoundments within the SCA Permit Area have been, and will continue to be used to control sediment during the operations and reclamation activities. The impoundments are discussed in Chapter Seven, sections 732, 733, 742 and 743.

Berms will also be used to control sedimentation from temporarily or permanently reclaimed areas. These berms will be used to ensure that drainage from the area in question will be treated.

9.11 MONITORING AND MAINTENANCE

This section addresses the concerns of the monitoring efforts that will take place during the mining period. This will consist of water, vegetation, and erosion monitoring activities.

9.11.1 Water

Impoundments which are subject to MSHA requirements are shown in Plate 5-~~47~~. These impoundments will be inspected weekly. Currently there are no impoundments subject to MSHA weekly inspection requirements.

Quarterly inspections of runoff and sediment control structures not subject to MSHA, 30 CFR 77.216, will be conducted. Evidence of berm or ditch overtopping, bypass, or erosion will be noted and any needed repairs or upgrading will take place at the time of inspection or shortly after, depending on the scope of work required. The sedimentation ponds will be certified annually and the certification included in the annual report.

APPENDIX 7-3
HYDROLOGIC DESIGN OF SEDIMENT PONDS

A.	Pasture Pond	-	updated February 2007
B.	Old Coarse Refuse Road Pond	-	updated September 15, 1993
C.	Coarse Refuse Toe Pond	-	updated October 22, 1993
D.	Rail Cut Pond	-	updated February 2011
F.	Borrow Area Pond	-	updated November 16, 1993
~~G.~~	~~East Slurry Cell~~		~~Updated January 1995~~
I.	Coal Pile Sediment Pond	-	Updated January 1995
J.	Miscellaneous Flows:		

~~Two 24" CMPs southeast of Old Coarse Refuse Road Pond – Updated November 18, 1993~~

36" CMP north of Coarse Refuse Toe Pond – updated March 1994

RAILCUT SEDIMENT POND

UPDES DISCHARGE 007
Reference Drawings 7-1, 7-8

Hydrologic and Sediment Parameters

10 year 24 hour storm
25 year 6 hour storm
100 year 6 hour storm

Diversion and culvert design criteria.

This appendix segment is a replacement for prior hydrologic calculations for the RailCut Pond and the East and West Slurry Cells. The watersheds which have hitherto drained into these ponds have been combined together as excavation on top of the Refuse Pile has progressed. The Railcut Pond is adequate to receive runoff from the combined watershed.

RAILCUT SEDIMENT POND - Hydrologic Calculations

INTRODUCTION

The RAILCUT Sediment Pond (UPDES 007) is located near the southwest corner of the permit area (see Plate 7-1). It collects drainage from the upper portion of the refuse pile and the industrial borrow area. The pond is an off channel, temporary sediment control structure, with a total as-built volume of approximately 4.8 acre-feet (top of bank). Surface water runoff and sediment runoff from a 113.7 acre watershed is captured by the pond.

The RAILCUT Pond has been in service for a number of decades. During the past several years, excavation of the Refuse Pile (including the former West and East Cells) has modified the drainage elevations such that these Cells are no longer impoundments and have been incorporated as part of the Refuse Pile. The new hydrologic modeling accompanying this appendix section includes the entire combined watershed now contributing to the Rail Cut Pond.

The structure is a temporary pond as addressed in R645-301-732.200. The structure does not meet the size or other qualifying criteria of the MSHA of 30 CFR 77.216(a). Therefore, it provides a combination of principal and emergency spillways that will safely discharge a 25 year, 6 hour event.

The pond contains a 2 inch drain pipe. This 2 inch pipe is normally closed but can be opened to discharge the pond following major storm events after appropriate settling times. The pond is modeled in Sedimot-II with the pond essentially considered empty when the storm begins.

The pond can discharge through a 48 inch drop inlet spillway when the water level reaches the stage elevation of 6212.34 (5.34 feet deep). The 48 inch pipe spillway is capable of passing the 25 year, 6 hour peak flow. The pond treats the 10 year, 24 hour storm such that effluent is well within the UPDES limits.

Culverts and diversion ditches are required to be designed for these watersheds using the 100 year 6 hour storm for refuse pile ditches / culverts and the 10 year 6 hour storm for non-refuse pile ditches. In an effort to provide a conservative design, SCA has designed them all for the 100 yr 6 hr storm.

Topsoil was removed prior to construction of the pile and is stored in a stockpile directly south of the pond. After the useful life of the pond, the area will be appropriately reclaimed.

RC-SWS1 84.9 ac 64.9
2 13
3 10.6
4 3.1
5 3.9 (?)
6 1.7 (?)
7 4.3 (?)
8 12.2

113.7
Σ = 133.7 ac

SUBWATERSHEDS

The RAIL CUT Pond drainage area is divided into eight sub watersheds for routing analysis. These are labeled as follows: RC-SWS1, RC-SWS2, RC-SWS3, RC-SWS4, RC-SWS6, RC-SWS7, and RC-SWS8 (see Plate 7-1).

SOIL TYPE

According to the SCS Soil Survey of Carbon Area, Utah, the soil type found in this drainage area is predominantly SCS # 114, Strych. Three soil samples from the adjacent Reclamation Borrow Area were analyzed by Huntingdon/Chen-Northern in the early 1990s. The particle size distribution from these samples was plotted and averaged for use in sediment modeling. Other soil characteristics are as follows:

SCS Soil Name	Strych
Submerged Specific Gravity	1.75
Specific Gravity	2.75
Erosion K value	0.20
Bulk Density	1.4

An estimated particle distribution was used for areas covered with refuse material.

CURVE NUMBERS

The RAIL CUT Pond curve numbers are based on the Soil Conservation Service graph. The soil types found on the site correspond to SCS hydrologic Class B as indicated in the SCS Soil Survey for Carbon Area, Utah. The vegetation cover is relatively sparse, consisting of a mixture of Juniper Grass, Mountain Brush, and Desert Brush. Curve numbers were averaged from these vegetation types. Areas covered with refuse material are expected to have minimal vegetation but a relatively high infiltration rate. Curve numbers were estimated for these areas.

TIME OF CONCENTRATION

Each sub watershed requires a certain time for the water to reach the outlet following the longest path. The runoff from these sub watersheds is approximated by Sedimot-II "Disturbed" unit hydrograph for areas with poor vegetative cover. The overland flow velocity was estimated using the Soil Conservation Service Upland Curves (SCS 1972) corresponding to the slope and vegetation of the drainage areas. Time of concentration was calculated by dividing the average velocity into the distance to the sub watershed outlet.

SUB WATERSHED CHARACTERISTICS

Drainage Area	SCS Hydro Class	Vegetation Cover Density	Juniper Grass CN	Mt. Brush CN	Desert Brush CN	**Average Curve Number**	Area acres	Distance to Outlet (ft)	Average Velocity (ft/s)	**Concentration (hrs)**
RC-SWS1	B	40%	62	65	81	**75**	13	1550	1.72	**0.25**
RC-SWS2	Refuse	0%				**70**	64.9	2600	1.2	**0.6**
RC-SWS3	Spoil	10%				**70**	10.6	2000	1.35	**0.40**
RC-SWS4	B	20%	74	77	83	**78**	3.1	1100	1.7	**0.17**
RC-SWS5	B	20%	74	77	83	**78**	3.9	850	1.69	**0.14**
RC-SWS6	B	25%	71	75	82	**75**	1.7	600	2.38	**0.07**
RC-SWS7	B	30%	68	72	82	**74**	4.3	800	1.71	**0.13**
RC-SWS8	B	40%	62	65	81	**70**	12.2	1800	1.65	**0.3**

ROUTING COEFFICIENTS

"Sedimot-II" uses Muskingum routing methods. Flows must be routed between structures or from a subwatershed outlet to the corresponding structure (if the outlet is not at the structure). No routing is used through sub watersheds that do not have inflow from a previous watershed, or structure (this water flow is accounted for with the time of concentration and the unit hydrograph). Areas requiring routing coefficients are indicated in the program output data. Muskingum coefficients K and X are used as follows:

K = Travel time through diversion.

$$X = \frac{0.5^* \text{ Velocity}}{1.7 + \text{Velocity}}$$

STORM RUNOFF VOLUMES AND DESIGN FLOWS

Storm Event	Total Runoff (acft)	Total Sediment (tons)	Pond Stage Elevation	D2 cfs	D3/C1 cfs	D4 cfs	D5 cfs	C2 cfs	C3 cfs	D7 cfs	D8 cfs	D9 cfs	Outlet cfs
10yr 24hr	2.0	680	6212.3	2.9	0.8	5.2	1.4	5.7	6.0	0.6	6.1	6.7	0.0
25yr 6 hr	1.3	557	6211.2	3.0	0.8	5.4	1.6	6.0	6.3	0.7	6.3	7.1	**0.0**
100yr 6hr	2.8	1314	6212.6	**6.3**	**2.3**	**13.7**	**2.9**	**15.0**	**15.7**	**1.2**	**15.7**	**17.2**	4.8

The flowline of the primary discharge (decant) pipe (and 100% sediment storage) is at elevation 6209.07. Sediment levels in the pond are allowed to fill to 60% of sediment capacity (6207.7) prior to a required cleaning. Adequate storage exists to treat the calculated storm runoff volumes and the projected sediment volume from the modeled storms.

The permittee is encouraged to perform the periodic cleaning to elevations lower than the minimum design depth to allow for additional sedimentation storage between cleaning events.

The 100 year 6 hour storm is projected to have a discharge from the pond. Detention time for this storm is modeled to be over 2 hours. This is expected to be adequate to allow settling to occur in the pond adequate to meet the UPDES discharge concentration volumes.

DIVERSION DESIGN

Temporary diversions and culverts for these miscellaneous flows are required to be designed to pass the 10 year, 6 hour storm (R645-301-742.333). Diversions on a refuse pile are required to be designed for the 100 year 6 hour storm. SCA has provided a design for the 100 yr 6 hr storm on all the ditches in this watershed. Permanent diversion designs are described in the permit term reclamation plan and final reclamation plan.

Design summaries are given in the tables below. The diversions were designed to fit within a range of expected field values. The flow depth and flow area are calculated by using the average channel slope and an assumed channel cross section. Due to the reality that the channel conditions will vary in the field, the critical value is to provide the minimum required cross sectional flow area for the storm flows to pass. Additional freeboard is not required in the regulations, but we have recommended that the operator may construct the diversions larger than required to reduce the risk of overflow from conditions not assumed in this hydrologic model.

100 yr - 6 hr ?✓

DIVERSION DESIGN CRITERIA

Ditch No.	Manning N	Side Slope minH/1V	Bottom Width (ft)	Design Flow (cfs)	Channel Slope Avg %	Flow Depth ft	Reqd Flow Area sqft	Maximum Velocity (ft/s)	Recommended Channel Depth (ft)
RC-D2	0.035	2	1	6.3 ✓	5.5	0.42	1.26	5.0	0.9
RC-D3	0.035	2	0	2.3 ✓	3	0.27	0.54	4.3	0.8
RC-D4	0.035	2	1	13.7 ✓	1	1.54	4.62	3.0	2.0
RC-D5	0.035	2	0	2.9 ✓	2	0.41	0.82	3.5	0.9
RC-D7	0.035	2	0	1.2 ✓	5	0.13	0.26	4.8	0.6
RC-D8	0.035	2	2	15.7 ✓	2.5	0.84	3.36	4.7	1.3
RC-D9	0.035	2	3	17.2 ✓	0.4	1.52	7.60	2.3	2.0

RIPRAP SIZING

Riprap is placed along steep channel slopes and at select culvert outlets to control erosion. The size of the stones is based on the expected maximum velocity of water flowing. When peak velocities in the smooth channel are expected to reach 5 ft/s, riprap is required. The operator may choose to add riprap in other channel areas where erosive conditions present a difficulty for the site. The riprap mixture should approximate the following gradation:

Stone Size	% Finer
$2*D_{50}$	100
D_{50}	50
$0.5*D_{50}$	20
$0.2*D_{50}$	0

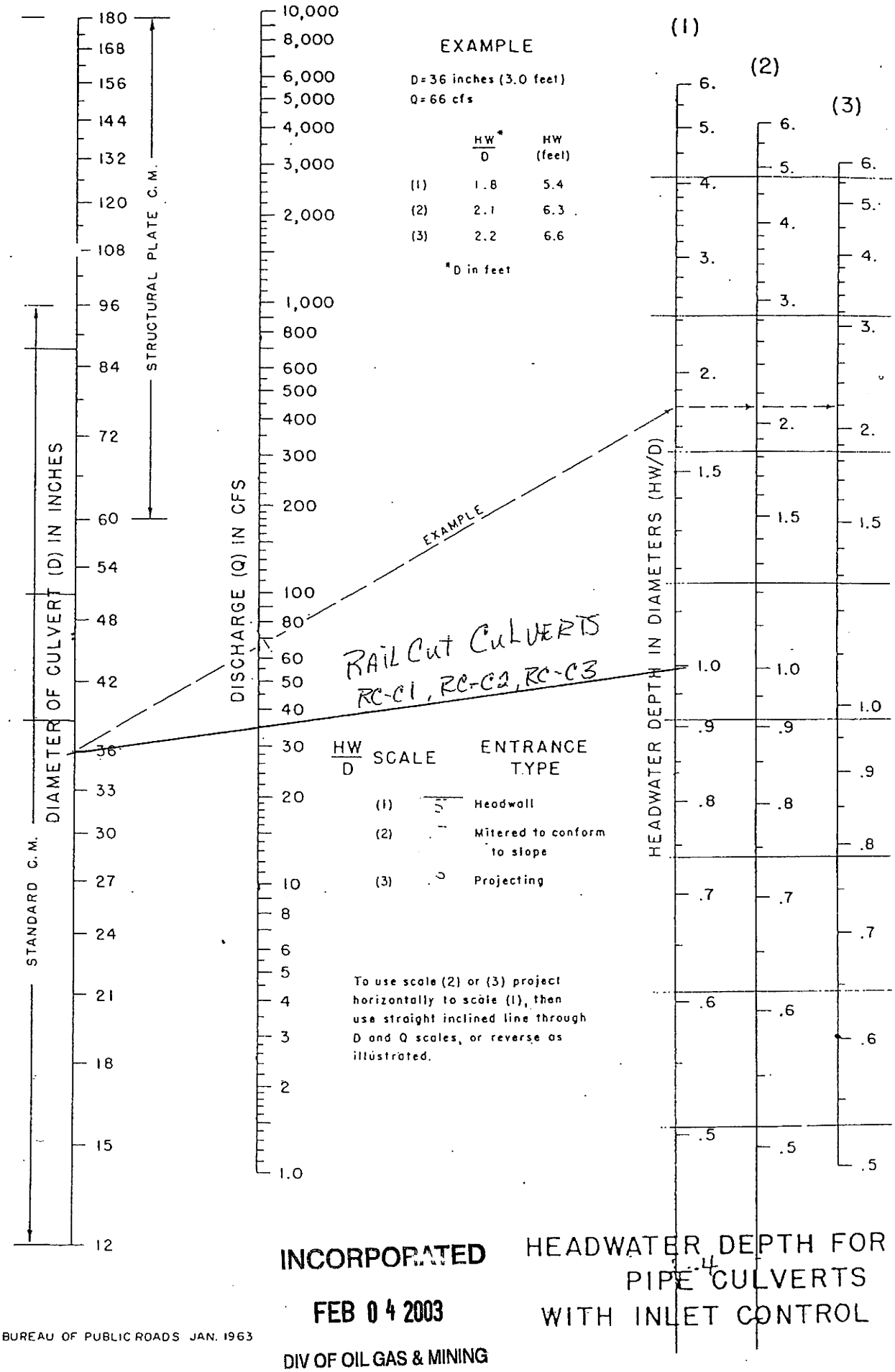
In areas where the increased roughness from riprap does not reduce the velocity below 5 ft/s, a filter blanket (or gravel bedding in a layer $3*D_{50}$) may be used.

The velocity expected in the channel is calculated by dividing the flow rate by the flow cross sectional area. Manning's N for a channel bed with riprap is estimated by the equation $N=0.0395*(D_{50})^{1/6}$ with D_{50} in feet (Applied Hydrology and Sedimentology for Disturbed Areas page 188). If the normal depth of flow is less than twice D_{50} then N is estimated by the equation $N=0.456*(D_{50}$ *Slope)0.159 with D_{50} in inches and slope in feet/feet (*Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase 1* May 1987, Colorado State University, prepared for Uranium Recovery Field Office and Division of Waste Management).

CULVERT DESIGN CRITERIA

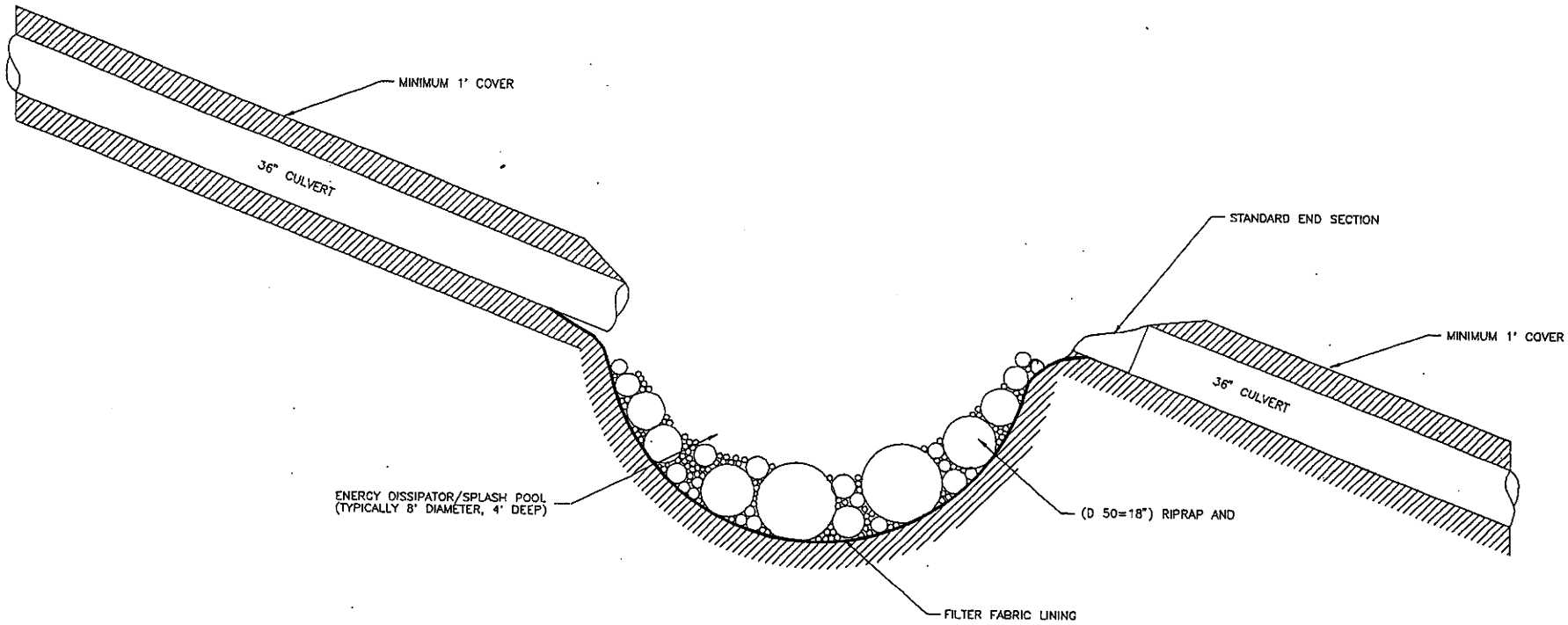
Culvert No	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope %	Controlling Head Water (Ft)	Design Flow (cfs)	Design Velocity (ft/s)	Inlet / Outlet Conditions
RC-C1 RC-C2 RC-C3	36	150	33	<2	**<25**	<10	Inlet end section and outlet splash pool

The three culverts installed on the face of the refuse pile were constructed with a standard end section for inlet control and an energy dissipating splash pool at the outlet. The 36" culverts are clearly overdesigned for the current conditions under the regulations but the permittee wished to minimize the potential for problems from flows greater than anticipated at the time of installation.



BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR PIPE CULVERTS WITH INLET CONTROL



TYPICAL DRAWING FOR INSTALLING OF 36" CULVERTS
RC-C1,RC-C2,RC-C3 AND ENERGY DISSIPATOR/SPLASH POOLS

RAIL CUT SEDIMENT POND

10 Year 24 Hour Storm Hydrologic Model

1

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University of Kentucky computer model
of surface mine hydrology and sedimentology
for more information contact the Agricultural
Engineering Department

the UK model is a design model developed to predict
the hydraulic and sediment response from surface
mined lands for a specified rainfall event (single storm)

version date 9-23-83

disclaimer: neither the University nor any of its employees
accept any responsibility or legal liability for the
conclusions drawn from the results of this model

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* *
* the following values are now predicted by SEDIMOT II. *
* they can be found in summary tables. *
* 1. period of significant concentration *
* 2. volume weighted average settleable concentration *
* during period of significant concentration *
* 3. volume weighted average settleable concentration *
* during peak 24 hour period *
* 4. arithmetic average settleable concentration during *
* period of significant concentration *
* 5. arithmetic average settleable concentration *
* during peak 24 hour period *
* *
* all concentrations are in ml/l. *
* *
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watershed identification code

Rail Cut Pond 10yr 24 hr operational January 2011

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1

input particle size-percent finer distributions
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size,mm	13.000	2.000	.425	.250	.150	.075
	.050	.030	.020	.010	.008	.006
	.004	.002	.000			
pct finer no. 1	94.300	83.700	78.000	73.300	66.300	45.000
	34.000	26.300	20.300	15.000	13.800	12.300
	11.000	10.000	.000			
pct finer no. 2	75.000	60.000	50.000	40.000	30.000	20.000
	10.000	8.000	7.000	6.000	5.000	4.000
	3.000	1.000	.000			

**********input values**********

storm duration	= 24.00	hours
precipation depth	= 1.84	inches
specific gravity	= 2.75	
load rate exponent factor	= 1.50	
submerged bulk specific gravity	= 1.40	

1

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junction 1, branch 1, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	13.00	75.00	.250	.000	.100	.35	1.0
2	64.90	70.00	.600	.150	.150	.35	1.0

SWS1
SWS2

69

SWS1 = 64.9 ac
SWS2 = 13 ac

SWS1 = 0.6
SWS2 = 0.25

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	20.00	.900	1.0	.0
2	1	.20	500.0	.50	.900	2.0	.0

RC-D2

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.90	.31	92.30	.059	.773	1.000
2	4.04	.18	5.93	.118	.531	.891

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	1.3226	acre-ft
peak discharge	=	5.0896	cfs
area	=	77.9000	acres
time of peak discharge	=	12.50	hrs
beta	=	2.2509	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	291671.50	mg/l
peak settleable concentration	=	165.61	ml/l
peak settleable concentration	=	231852.60	mg/l
total sediment yield	=	97.5772	tons
representative particle size	=	.0611	mm
time of peak concentration	=	12.10	hrs
period of significant concentration	=	13.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	29.28	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	29.28	ml/l
arithmetic average settleable concentration during period of significant concentration	=	18.92	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	10.88	ml/l

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null structure
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junction 1, branch 1, structure 2
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.10 ✓	78.00 ✓	.170 ✓	.000	.000	.00	1.0

SWS 4

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.13	.40	105.11	.071	.874	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1027	acre-ft
peak discharge	=	1.1273	cfs
area	=	3.1000	acres
time of peak discharge	=	12.10	hrs
beta	=	1.0000	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	989117.80	mg/l
peak settleable concentration	=	574.91	ml/l
peak settleable concentration	=	804868.30	mg/l
total sediment yield	=	105.1132	tons
representative particle size	=	.0715	mm
time of peak concentration	=	12.10	hrs
period of significant concentration	=	12.70	hrs
volume weighted average settleable			

concentration during period of significant concentration	=	318.59	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	318.59	ml/l
arithmetic average settleable concentration during period of significant concentration	=	200.12	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	105.90	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	4.99	cfs
time of routed peak discharge	=	12.70	hrs
total drainage area	=	81.00	acres
total runoff volume	=	1.4252	ac-ft
peak runoff discharge	=	5.23	cfs
time to peak discharge	=	12.70	hrs
previous structure delivery ratio	=	.96	
previous structure travel time	=	.1500	hrs
total sediment yield	=	199.1387	tons
peak sediment concentration	=	756818.40	mg/l
peak settleable concentration	=	433.2443	ml/l
peak settleable concentration	=	606542.10	mg/l
time to peak concentration	=	12.00	hrs
period of significant concentration	=	13.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	52.10	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	52.10	ml/l
arithmetic average settleable concentration during period of significant concentration	=	39.69	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	22.82	ml/l

RC-D4

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null structure
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junction 1, branch 2, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	10.60	70.00	.400	.050	.050	.35	1.0

SWS3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	2.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.83	.18	37.29	.151	.602	1.000

note: sediment does not include possible deposition by delivery ratio 2

RC-D3

***** summary table for total watershed *****

runoff volume	=	.1620	acre-ft
peak discharge	=	.8263	cfs
area	=	10.6000	acres
time of peak discharge	=	12.30	hrs
beta	=	.0100	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	282597.30	mg/l
peak settleable concentration	=	180.91	ml/l
peak settleable concentration	=	253276.90	mg/l
total sediment yield	=	37.2857	tons
representative particle size	=	.1506	mm
time of peak concentration	=	12.30	hrs
period of significant concentration	=	13.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	100.75	ml/l
volume weighted average settleable			

concentration during peak 24 hour period = 100.75 ml/l
arithmetic average settleable concentration during period of significant concentration = 76.14 ml/l
arithmetic average settleable concentration during peak 24 hour period = 41.56 ml/l

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null structure
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junction 2, branch 1, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.90 ✓	78.00 ✓	.140 ✓	.000	.100	.35	1.0

SWS5

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

RC-DS

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.43 ✓	.40	98.46	.072	.877	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1292	acre-ft
peak discharge	=	1.3280	cfs
area	=	3.9000	acres
time of peak discharge	=	12.20	hrs
beta	=	1.0000	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	799918.40	mg/l
peak settleable concentration	=	465.30	ml/l
peak settleable concentration	=	651423.00	mg/l
total sediment yield	=	98.4636	tons
representative particle size	=	.0719	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	12.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	254.14	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	254.14	ml/l
arithmetic average settleable concentration during period of significant concentration	=	156.99	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	83.07	ml/l

summary table of combined hydrograph and sedigraph values

RC-C2

RC-C3

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	5.73	cfs
time of routed peak discharge	=	12.80	hrs
total drainage area	=	95.50	acres
total runoff volume	=	1.7164	ac-ft
peak runoff discharge	=	6.04	cfs
time to peak discharge	=	12.80	hrs
previous structure delivery ratio	=	.96	
previous structure travel time	=	.1500	hrs
total sediment yield	=	325.6114	tons
peak sediment concentration	=	728843.10	mg/l
peak settleable concentration	=	422.0505	ml/l
peak settleable concentration	=	590870.70	mg/l
time to peak concentration	=	12.10	hrs
period of significant concentration	=	13.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	70.89	ml/l

volume weighted average settleable concentration during peak 24 hour period = 70.89 ml/l
arithmetic average settleable concentration during period of significant concentration = 49.66 ml/l
arithmetic average settleable concentration during peak 24 hour period = 28.55 ml/l

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null structure
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junction 2, branch 2, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.70	75.00	.070	.000	.020	.40	.0

SWS 6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

RC-D7

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.57	.31	27.80	.088	1.000	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume =	.0433	acre-ft
peak discharge =	.5680	cfs
area =	1.7000	acres
time of peak discharge =	12.00	hrs
beta =	1.0000	
rainfall erositivity factor =	18.15	ei unit
peak concentration =	784970.60	mg/l
peak settleable concentration =	469.00	ml/l
peak settleable concentration =	656600.50	mg/l
total sediment yield =	27.7976	tons
representative particle size =	.0883	mm
time of peak concentration =	12.00	hrs
period of significant concentration =	12.10	hrs
volume weighted average settleable concentration during period of significant concentration =	230.32	ml/l
volume weighted average settleable concentration during peak 24 hour period =	230.32	ml/l
arithmetic average settleable concentration during period of significant concentration =	145.10	ml/l
arithmetic average settleable concentration during peak 24 hour period =	73.15	ml/l

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null structure
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junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	74.00	.130	.080	.080	.35	1.0
2	12.20	70.00	.300	.000	.000	.00	1.0

SWS 7
SWS 8

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.99	.28	129.44	.066	.832	.980
2	1.10	.18	209.24	.046	.652	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.2861	acre-ft
peak discharge	=	1.9689	cfs
area	=	16.5000	acres
time of peak discharge	=	12.20	hrs
beta	=	1.0000	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	1069361.00	mg/l
peak settleable concentration	=	589.49	ml/l
peak settleable concentration	=	825289.10	mg/l
total sediment yield	=	336.0449	tons
representative particle size	=	.0524	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	12.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	346.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	346.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	264.28	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	142.05	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	6.07	cfs — RC-D8
time of routed peak discharge	=	12.90	hrs
total drainage area	=	113.70	acres
total runoff volume	=	2.0457	ac-ft
peak runoff discharge	=	6.67	cfs — RC-D9
time to peak discharge	=	12.90	hrs
previous structure delivery ratio	=	.97	
previous structure travel time	=	.1000	hrs
total sediment yield	=	680.2446	tons
peak sediment concentration	=	883915.00	mg/l
peak settleable concentration	=	498.7758	ml/l
peak settleable concentration	=	698286.10	mg/l
time to peak concentration	=	12.20	hrs
period of significant concentration	=	13.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	116.36	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	116.36	ml/l
arithmetic average settleable concentration during period of significant concentration	=	84.05	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	48.33	ml/l

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pond results

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***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.046	acre-ft
outflow routed volume	=	.031	acre-ft
storm volume discharged (plug flow)	=	.031	acre-ft
pond volume at peak stage	=	2.132	acre-ft
peak stage	=	5.304	ft
peak inflow rate	=	6.669	cfs
peak discharge rate	=	.010	cfs
peak inflow sediment concentration	=	883915.00	mg/l
peak effluent sediment concentration	=	200046.70	mg/l
peak effluent settleable concentration	=	.0002	ml/l
peak effluent settleable concentration	=	.30	mg/l
storm average effluent concentration	=	40839.38	mg/l
average effluent sediment concentration	=	40839.38	mg/l
basin trap efficiency	=	99.75	percent
detention time of flow with sediment	=	14.96	hrs
detention time from hydrograph centers	=	14.96	hrs
detention time including stored flow	=	14.96	hrs
sediment load discharged	=	1.71	tons
period of significant concentration	=	38.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC1024

Rail Cut Pond 10yr 24 hr operational January 2011 X

```
     2        0
  1.84    24.00      .10      .00
     3        2
     2        2        1
  2.75     1.50     1.40
     2       15
13.0000   2.0000   .4250    .2500    .1500    .0750    .0500    .0300    .0200    .0100
  .0080    .0060    .0040    .0020    .0001
 94.30    83.70    78.00    73.30    66.30    45.00    34.00    26.30    20.30    15.00
 13.80    12.30    11.00    10.00      .00
 75.00    60.00    50.00    40.00    30.00    20.00    10.00     8.00     7.00     6.00
  5.00     4.00     3.00     1.00      .00
     2        1
  .000     .000     .000     .150     .150     .350
  .000     .000     .000
     1        1
  .150     .150     .400
  .000     .000     .000
     1
  .100     .100     .350
     2        1        1        1        1
13.000   75.000     .250     .000     .100     .350    1.000    1.000     .000
 .2000150.0000 20.0000   .9000  1.0000
64.900   70.000     .600     .150     .150     .350    1.000    1.000     .000
 .2000500.0000   .5000   .9000  2.0000
     1        1        1        1        1
 3.100   78.000     .170     .000     .000     .000    1.000    1.000     .000
 .2000100.0000 45.0000  1.0000  1.0000
     1        1        1        1        1
10.600   70.000     .400     .050     .050     .350    1.000    1.000     .000
 .2000 40.0000 35.0000   .9000  2.0000
     1        1        1        1        1
 3.900   78.000     .140     .000     .100     .350    1.000    1.000     .000
 .2000150.0000 33.0000  1.0000  1.0000
     1        1        1        1        1
 1.700   75.000     .070     .000     .020     .400    1.000    1.000     .000
 .2000100.0000 35.0000  1.0000  1.0000
     2        2        1        1        1
 4.300   74.000     .130     .080     .080     .350    1.000    1.000     .000
 .2000300.0000 37.0000  1.0000  1.0000
12.200   70.000     .300     .000     .000     .000    1.000    1.000     .000
 .2000400.0000 35.0000  1.0000  1.0000
   .20     1.00    20.00
     3        0       13      500        1        1        2
   .00     1.00     2.00     3.00     4.00     5.00     5.34     5.40     5.50     5.60
  6.00     7.00     8.00
  .000     .170     .340     .460     .590     .700     .760     .770     .790     .800
  .870    1.040    1.270
   .00      .00      .01      .01      .01      .01      .01      .57     2.49     5.16
 20.89    25.00    30.00
```

RAIL CUT SEDIMENT POND

25 Year 6 Hour Storm Hydrologic Model

```
**********************************************************************
**********************************************************************

      University of Kentucky computer model
      of surface mine hydrology and sedimentology
      for more information contact the Agricultural
      Engineering Department

      the UK model is a design model developed to predict
      the hydraulic and sediment response from surface
      mined lands for a specified rainfall event (single storm)

      version date 9-23-83

      disclaimer: neither the University nor any of its employees
      accept any responsibility or legal liability for the
      conclusions drawn from the results of this model

**********************************************************************
**********************************************************************



**********************************************************************
*                                                                    *
*     the following values are now predicted by SEDIMOT II.          *
*     they can be found in summary tables.                           *
*      1. period of significant concentration                        *
*      2. volume weighted average settleable concentration           *
*         during period of significant concentration                 *
*      3. volume weighted average settleable concentration           *
*         during peak 24 hour period                                 *
*      4. arithmetic average settleable concentration during         *
*         period of significant concentration                        *
*      5. arithmetic average settleable concentration                *
*         during peak 24 hour period                                 *
*                                                                    *
*     all concentrations are in ml/l.                                *
*                                                                    *
**********************************************************************
```



```
*********************************************

     watershed identification code
     -----------------------------
     Rail Cut Pond  25yr 6 hr  operational  January 2011

*********************************************

     input particle size-percent finer distributions
     -----------------------------------------------

size,mm           13.000  2.000   .425   .250   .150   .075
                    .050   .030   .020   .010   .008   .006
                    .004   .002   .000
pct finer no. 1   94.300 83.700 78.000 73.300 66.300 45.000
                  34.000 26.300 20.300 15.000 13.800 12.300
                  11.000 10.000   .000
pct finer no. 2   75.000 60.000 50.000 40.000 30.000 20.000
                  10.000  8.000  7.000  6.000  5.000  4.000
                   3.000  1.000   .000

  ********************input values*********************

  storm duration                      =       6.00   hours
  precipation depth                   =       1.62   inches
  specific gravity                    =       2.75
  load rate exponent factor           =       1.50
  submerged bulk specific gravity     =       1.40

          * * * * * * * * * * * * * * * * * * * * * *
             junction  1, branch  1, structure  1
          * * * * * * * * * * * * * * * * * * * * * *

        *** hydraulic input values for subwatersheds ***

 water    area    curve      tc      tt   routing coefficients   unit
 shed     acres   number     hr      hr       k-hrs       x       hydro
-------------------------------------------------------------------------
   1      13.00    75.00    .250     .000      .100       .35      1.0
   2      64.90    70.00    .600     .150      .150       .35      1.0

        *** sediment input values for subwatersheds ***

 water   seg      soil       length      slope      cp        part      surf
 shed    num       k          feet        pct      value      opt       cond
-------------------------------------------------------------------------
   1      1       .20        150.0       20.00     .900       1.0       .0
   2      1       .20        500.0         .50     .900       2.0       .0
```

SWS 1
SWS 2

RC-D2

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	3.00	.21	76.63	.054	.719	1.000
2	3.90	.12	4.48	.102	.490	.914

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.8531	acre-ft
peak discharge	=	5.2375	cfs
area	=	77.9000	acres
time of peak discharge	=	3.60	hrs
beta	=	1.8854	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	270442.40	mg/l
peak settleable concentration	=	150.74	ml/l
peak settleable concentration	=	211034.10	mg/l
total sediment yield	=	80.7235	tons
representative particle size	=	.0554	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	4.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	36.78	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	36.78	ml/l
arithmetic average settleable concentration during period of significant concentration	=	27.83	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	5.45	ml/l

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 1, branch 1, structure 2
* *

*** hydraulic input values for subwatersheds ***

GWS 4

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.10 ✓	78.00 ✓	.170 ✓	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.22	.29	91.81	.066	.829	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0743	acre-ft
peak discharge	=	1.2231	cfs
area	=	3.1000	acres
time of peak discharge	=	3.10	hrs
beta	=	1.0000	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	964642.90	mg/l
peak settleable concentration	=	554.14	ml/l
peak settleable concentration	=	775799.20	mg/l
total sediment yield	=	91.8058	tons
representative particle size	=	.0658	mm
time of peak concentration	=	3.10	hrs
period of significant concentration	=	3.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	374.08	ml/l
volume weighted average settleable			

concentration during peak 24 hour period	= 374.08	ml/l
arithmetic average settleable concentration during period of significant concentration	= 284.66	ml/l
arithmetic average settleable concentration during peak 24 hour period	= 42.70	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	= .35	
previous muskingum routing k	= .1500	hrs
previous routed peak discharge	= 5.12	cfs
time of routed peak discharge	= 3.80	hrs
total drainage area	= 81.00	acres
total runoff volume	= .9274	ac-ft
peak runoff discharge	= 5.38	cfs
time to peak discharge	= 3.70	hrs
previous structure delivery ratio	= .97	
previous structure travel time	= .1500	hrs
total sediment yield	= 169.7279	tons
peak sediment concentration	= 796677.90	mg/l
peak settleable concentration	= 449.4240	ml/l
peak settleable concentration	= 629193.60	mg/l
time to peak concentration	= 3.00	hrs
period of significant concentration	= 4.70	hrs
volume weighted average settleable concentration during period of significant concentration	= 66.54	ml/l
volume weighted average settleable concentration during peak 24 hour period	= 66.54	ml/l
arithmetic average settleable concentration during period of significant concentration	= 68.32	ml/l
arithmetic average settleable concentration during peak 24 hour period	= 13.38	ml/l

RC-04

* * * * * * * * * * * * *
null structure
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1

* *
junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	10.60	70.00	.400	.050	.050	.35	1.0

SWS 3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	2.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.79	.12	28.10	.128	.553	1.000

RC-03

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	= .1018	acre-ft
peak discharge	= .7931	cfs
area	= 10.6000	acres
time of peak discharge	= 3.30	hrs
beta	= .0100	
rainfall erositivity factor	= 24.10	ei unit
peak concentration	= 253116.70	mg/l
peak settleable concentration	= 160.44	ml/l
peak settleable concentration	= 224622.10	mg/l
total sediment yield	= 28.0993	tons
representative particle size	= .1275	mm
time of peak concentration	= 3.30	hrs
period of significant concentration	= 4.00	hrs
volume weighted average settleable concentration during period of significant concentration	= 118.82	ml/l
volume weighted average settleable		

concentration during peak 24 hour period	=	118.82 ml/l
arithmetic average settleable concentration during period of significant concentration	=	96.83 ml/l
arithmetic average settleable concentration during peak 24 hour period	=	16.14 ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.90 ✓	78.00 ✓	.140 ✓	.000	.100	.35	1.0

SUBS

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.55 ✓	.29	86.04	.066	.832	1.000

RC-D5

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0935	acre-ft
peak discharge	=	1.4278	cfs
area	=	3.9000	acres
time of peak discharge	=	3.20	hrs
beta	=	1.0000	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	777814.10	mg/l
peak settleable concentration	=	447.23	ml/l
peak settleable concentration	=	626126.30	mg/l
total sediment yield	=	86.0404	tons
representative particle size	=	.0662	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	300.02	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	300.02	ml/l
arithmetic average settleable concentration during period of significant concentration	=	227.61	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	34.14	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	5.95	cfs — RC-C2
time of routed peak discharge	=	3.90	hrs
total drainage area	=	95.50	acres
total runoff volume	=	1.1227	ac-ft
peak runoff discharge	=	6.27	cfs — RC-C3
time to peak discharge	=	3.90	hrs
previous structure delivery ratio	=	.96	
previous structure travel time	=	.1500	hrs
total sediment yield	=	276.4603	tons
peak sediment concentration	=	737605.60	mg/l
peak settleable concentration	=	420.9576	ml/l
peak settleable concentration	=	589340.60	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	4.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	89.79	ml/l

volume weighted average settleable concentration during peak 24 hour period	=	89.79	ml/l
arithmetic average settleable concentration during period of significant concentration	=	79.31	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	15.53	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.70	75.00	.070	.000	.020	.40	.0

SWS6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.65	.21	24.47	.088	1.000	1.000

RC-D7

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0300	acre-ft
peak discharge	=	.6516	cfs
area	=	1.7000	acres
time of peak discharge	=	3.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	792434.10	mg/l
peak settleable concentration	=	473.46	ml/l
peak settleable concentration	=	662843.40	mg/l
total sediment yield	=	24.4673	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.00	hrs
period of significant concentration	=	3.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	290.68	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	290.68	ml/l
arithmetic average settleable concentration during period of significant concentration	=	226.19	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	28.27	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	74.00	.130	.080	.080	.35	1.0
2	12.20	70.00	.300	.000	.000	.00	1.0

SWS7
SWS8

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.02	.19	106.36	.060	.776	.981
2	1.07	.12	159.07	.039	.605	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1852	acre-ft
peak discharge	=	1.9676	cfs
area	=	16.5000	acres
time of peak discharge	=	3.20	hrs
beta	=	1.0000	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	1011257.00	mg/l
peak settleable concentration	=	546.48	ml/l
peak settleable concentration	=	765071.80	mg/l
total sediment yield	=	263.3718	tons
representative particle size	=	.0465	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	399.70	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	399.70	ml/l
arithmetic average settleable concentration during period of significant concentration	=	331.79	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	52.53	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	6.33	cfs
time of routed peak discharge	=	4.00	hrs
total drainage area	=	113.70	acres
total runoff volume	=	1.3380	ac-ft
peak runoff discharge	=	7.06	cfs
time to peak discharge	=	3.90	hrs
previous structure delivery ratio	=	.97	
previous structure travel time	=	.1000	hrs
total sediment yield	=	556.7697	tons
peak sediment concentration	=	856261.90	mg/l
peak settleable concentration	=	475.7320	ml/l
peak settleable concentration	=	666024.80	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	4.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	141.37	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	141.37	ml/l
arithmetic average settleable concentration during period of significant concentration	=	119.88	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	23.48	ml/l

RC-D8

RC-D9

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	1.338	acre-ft
outflow routed volume	=	.038	acre-ft
storm volume discharged (plug flow)	=	.038	acre-ft
pond volume at peak stage	=	1.425	acre-ft
peak stage	=	4.248	ft
peak inflow rate	=	7.059	cfs
peak discharge rate	=	.010	cfs
peak inflow sediment concentration	=	856261.90	mg/l
peak effluent sediment concentration	=	206269.20	mg/l
peak effluent settleable concentration	=	.0002	ml/l
peak effluent settleable concentration	=	.31	mg/l
storm average effluent concentration	=	50178.64	mg/l
average effluent sediment concentration	=	50178.64	mg/l
basin trap efficiency	=	99.53	percent
detention time of flow with sediment	=	22.02	hrs
detention time from hydrograph centers	=	22.02	hrs
detention time including stored flow	=	22.02	hrs
sediment load discharged	=	2.61	tons
period of significant concentration	=	46.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC25-6

Rail Cut Pond 25yr 6 hr operational January 2011 X

```
         2         0
      1.62      6.00       .10       .00
         3         2
         2         2         1
      2.75      1.50      1.40
         2        15
   13.0000    2.0000    .4250    .2500    .1500    .0750    .0500    .0300    .0200    .0100
     .0080     .0060     .0040    .0020    .0001
     94.30     83.70     78.00    73.30    66.30    45.00    34.00    26.30    20.30    15.00
     13.80     12.30     11.00    10.00      .00
     75.00     60.00     50.00    40.00    30.00    20.00    10.00     8.00     7.00     6.00
      5.00      4.00      3.00     1.00      .00
         2         1
      .000      .000      .000     .150     .150     .350
      .000      .000      .000
         1         1
      .150      .150      .400
      .000      .000      .000
         1
      .100      .100      .350
         2         1         1        1        1
   13.000    75.000      .250     .000     .100     .350    1.000    1.000     .000
    .200015 0.0000  20.0000     .9000   1.0000
   64.900    70.000      .600     .150     .150     .350    1.000    1.000     .000
    .200050 0.0000     .5000     .9000   2.0000
         1         1         1        1        1
    3.100    78.000      .170     .000     .000     .000    1.000    1.000     .000
    .200010 0.0000  45.0000     1.0000   1.0000
         1         1         1        1        1
   10.600    70.000      .400     .050     .050     .350    1.000    1.000     .000
    .2000  40.0000  35.0000     .9000   2.0000
         1         1         1        1        1
    3.900    78.000      .140     .000     .100     .350    1.000    1.000     .000
    .200015 0.0000  33.0000     1.0000   1.0000
         1         1         1        1        1
    1.700    75.000      .070     .000     .020     .400    1.000    1.000     .000
    .200010 0.0000  35.0000     1.0000   1.0000
         2         2         1        1        1
    4.300    74.000      .130     .080     .080     .350    1.000    1.000     .000
    .200030 0.0000  37.0000     1.0000   1.0000
   12.200    70.000      .300     .000     .000     .000    1.000    1.000     .000
    .200040 0.0000  35.0000     1.0000   1.0000
        .20      1.00     20.00
         3         0        13      500        1        1        2
        .00      1.00      2.00     3.00     4.00     5.00     5.34     5.40     5.50     5.60
       6.00      7.00      8.00
      .000      .170      .340     .460     .590     .700     .760     .770     .790     .800
      .870     1.040     1.270
       .00       .00       .01      .01      .01      .01      .01      .57     2.49     5.16
     20.89     25.00     30.00
```

RAIL CUT SEDIMENT POND

100 Year 6 Hour Storm Hydrologic Model

1

```
*****************************************************************
*****************************************************************

       University of Kentucky computer model
       of surface mine hydrology and sedimentology
       for more information contact the Agricultural
       Engineering Department

       the UK model is a design model developed to predict
       the hydraulic and sediment response from surface
       mined lands for a specified rainfall event (single storm)

       version date 9-23-83

       disclaimer: neither the University nor any of its employees
       accept any responsibility or legal liability for the
       conclusions drawn from the results of this model

*****************************************************************
*****************************************************************


*****************************************************************
*                                                               *
*     the following values are now predicted by SEDIMOT II.     *
*     they can be found in summary tables.                      *
*      1. period of significant concentration                   *
*      2. volume weighted average settleable concentration      *
*         during period of significant concentration            *
*      3. volume weighted average settleable concentration      *
*         during peak 24 hour period                            *
*      4. arithmetic average settleable concentration during    *
*         period of significant concentration                   *
*      5. arithmetic average settleable concentration           *
*         during peak 24 hour period                            *
*                                                               *
*     all concentrations are in ml/l.                           *
*                                                               *
*****************************************************************
```



```
*********************************************

     watershed identification code
     -----------------------------
     Rail Cut Pond  100yr 6 hr  operational  January 2011

*********************************************
```

1

input particle size-percent finer distributions

size,mm	13.000	2.000	.425	.250	.150	.075
	.050	.030	.020	.010	.008	.006
	.004	.002	.000			
pct finer no. 1	94.300	83.700	78.000	73.300	66.300	45.000
	34.000	26.300	20.300	15.000	13.800	12.300
	11.000	10.000	.000			
pct finer no. 2	75.000	60.000	50.000	40.000	30.000	20.000
	10.000	8.000	7.000	6.000	5.000	4.000
	3.000	1.000	.000			

**********input values**********

storm duration	=	6.00	hours
precipation depth	=	2.05	inches
specific gravity	=	2.75	
load rate exponent factor	=	1.50	
submerged bulk specific gravity	=	1.40	

1

```
* * * * * * * * * * * * * * * * * * * * * * * *
   junction  1, branch  1, structure  1
* * * * * * * * * * * * * * * * * * * * * * * *
```

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	13.00	75.00	.250	.000	.100	.35	1.0
2	64.90	70.00	.600	.150	.150	.35	1.0

SWS1
SWS2

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	20.00	.900	1.0	.0
2	1	.20	500.0	.50	.900	2.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	6.29 DZ	.41	166.97	.059	.772	1.000
2	11.44	.26	12.91	.127	.552	.913

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	1.8442	acre-ft
peak discharge	=	13.6511	cfs
area	=	77.9000	acres
time of peak discharge	=	3.50	hrs
beta	=	1.6938	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	281995.10	mg/l
peak settleable concentration	=	160.38	ml/l
peak settleable concentration	=	224526.50	mg/l
total sediment yield	=	178.7573	tons
representative particle size	=	.0617	mm
time of peak concentration	=	3.10	hrs
period of significant concentration	=	4.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	38.33	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	38.33	ml/l
arithmetic average settleable concentration during period of significant concentration	=	27.76	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	5.55	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

* *
junction 1, branch 1, structure 2
* *

*** hydraulic input values for subwatersheds ***

SWS 4

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.10 ✓	78.00 ✓	.170 ✓	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.26	.51	178.86	.071	.867	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1324	acre-ft
peak discharge	=	2.2575	cfs
area	=	3.1000	acres
time of peak discharge	=	3.10	hrs
beta	=	.6518	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	1009434.00	mg/l
peak settleable concentration	=	585.70	ml/l
peak settleable concentration	=	819977.40	mg/l
total sediment yield	=	178.8580	tons
representative particle size	=	.0706	mm
time of peak concentration	=	3.10	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	401.91	ml/l
volume weighted average settleable concentration during peak 24 hour			

period	=	401.91	ml/l
arithmetic average settleable concentration during period of significant concentration	=	290.15	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	44.73	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	13.23	cfs
time of routed peak discharge	=	3.70	hrs
total drainage area	=	81.00	acres
total runoff volume	=	1.9766	ac-ft
peak runoff discharge	=	13.72	cfs
time to peak discharge	=	3.70	hrs
previous structure delivery ratio	=	.98	
previous structure travel time	=	.1500	hrs
total sediment yield	=	353.3277	tons
peak sediment concentration	=	770804.90	mg/l
peak settleable concentration	=	441.6089	ml/l
peak settleable concentration	=	618252.40	mg/l
time to peak concentration	=	3.00	hrs
period of significant concentration	=	4.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	65.92	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	65.92	ml/l
arithmetic average settleable concentration during period of significant concentration	=	67.91	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	13.58	ml/l

- RC-D4

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	10.60	70.00	.400	.050	.050	.35	1.0

SW53

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	2.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.32	.26	80.89	.159	.624	1.000

RC D3

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.2294	acre-ft
peak discharge	=	2.3247	cfs
area	=	10.6000	acres
time of peak discharge	=	3.30	hrs
beta	=	.0100	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	336700.90	mg/l
peak settleable concentration	=	216.42	ml/l
peak settleable concentration	=	302984.80	mg/l
total sediment yield	=	80.8726	tons
representative particle size	=	.1594	mm
time of peak concentration	=	3.30	hrs
period of significant concentration	=	4.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	150.45	ml/l
volume weighted average settleable			

concentration during peak 24 hour
period = 150.45 ml/l
arithmetic average settleable
concentration during period of
significant concentration = 112.63 ml/l
arithmetic average settleable
concentration during peak 24 hour
period = 19.24 ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.90	78.00	.140	.000	.100	.35	1.0

SWSS

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

Rc-D5

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.86	.51	167.58	.071	.870	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1666	acre-ft
peak discharge	=	2.6545	cfs
area	=	3.9000	acres
time of peak discharge	=	3.20	hrs
beta	=	.6855	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	819407.40	mg/l
peak settleable concentration	=	475.84	ml/l
peak settleable concentration	=	666170.90	mg/l
total sediment yield	=	167.5769	tons
representative particle size	=	.0710	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	323.79	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	323.79	ml/l
arithmetic average settleable concentration during period of significant concentration	=	232.03	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	35.77	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	15.04	cfs — Rc-C2
time of routed peak discharge	=	3.80	hrs
total drainage area	=	95.50	acres
total runoff volume	=	2.3727	ac-ft
peak runoff discharge	=	15.66	cfs — RC-C3
time to peak discharge	=	3.80	hrs
previous structure delivery ratio	=	.97	
previous structure travel time	=	.1500	hrs
total sediment yield	=	589.8639	tons
peak sediment concentration	=	726273.50	mg/l
peak settleable concentration	=	422.5699	ml/l
peak settleable concentration	=	591597.80	mg/l
time to peak concentration	=	3.10	hrs
period of significant concentration	=	4.80	hrs
volume weighted average settleable			

concentration during period of significant concentration	=	92.08	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	92.08	ml/l
arithmetic average settleable concentration during period of significant concentration	=	79.49	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	15.90	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.70	75.00	.070	.000	.020	.40	.0

SWS 6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

RC-07

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.24	.41	50.39	.088	1.000	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0575	acre-ft
peak discharge	=	1.2369	cfs
area	=	1.7000	acres
time of peak discharge	=	3.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	806201.40	mg/l
peak settleable concentration	=	481.69	ml/l
peak settleable concentration	=	674359.30	mg/l
total sediment yield	=	50.3851	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.00	hrs
period of significant concentration	=	3.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	306.47	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	306.47	ml/l
arithmetic average settleable concentration during period of significant concentration	=	223.70	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	28.90	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	74.00	.130	.080	.080	.35	1.0
2	12.20	70.00	.300	.000	.000	.00	1.0

SWS 7
SWS 8

*** sediment input values for subwatersheds ***

watershed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.23	.37	240.58	.067	.835	.980
2	3.11	.26	455.81	.050	.679	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.3979	acre-ft
peak discharge	=	5.0731	cfs
area	=	16.5000	acres
time of peak discharge	=	3.20	hrs
beta	=	1.0000	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	1157116.00	mg/l
peak settleable concentration	=	641.74	ml/l
peak settleable concentration	=	898435.10	mg/l
total sediment yield	=	691.4752	tons
representative particle size	=	.0539	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	468.59	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	468.59	ml/l
arithmetic average settleable concentration during period of significant concentration	=	369.31	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	60.01	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	15.69	cfs - RC-D8
time of routed peak discharge	=	3.90	hrs
total drainage area	=	113.70	acres
total runoff volume	=	2.8280	ac-ft
peak runoff discharge	=	17.19	cfs - RC-D9
time to peak discharge	=	3.80	hrs
previous structure delivery ratio	=	.97	
previous structure travel time	=	.1000	hrs
total sediment yield	=	1314.8130	tons
peak sediment concentration	=	959896.30	mg/l
peak settleable concentration	=	543.7445	ml/l
peak settleable concentration	=	761242.30	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	4.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	155.78	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	155.78	ml/l
arithmetic average settleable concentration during period of significant concentration	=	126.51	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	25.30	ml/l

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.828	acre-ft
outflow routed volume	=	.794	acre-ft
storm volume discharged (plug flow)	=	.794	acre-ft
pond volume at peak stage	=	2.352	acre-ft
peak stage	=	5.588	ft
peak inflow rate	=	17.189	cfs
peak discharge rate	=	4.840	cfs ~ outlet
peak inflow sediment concentration	=	959896.30	mg/l
peak effluent sediment concentration	=	364967.90	mg/l
peak effluent settleable concentration	=	.0004	ml/l
peak effluent settleable concentration	=	.54	mg/l
storm average effluent concentration	=	70856.30	mg/l
average effluent sediment concentration	=	70856.30	mg/l
basin trap efficiency	=	94.17	percent
detention time of flow with sediment	=	3.00	hrs
detention time from hydrograph centers	=	3.00	hrs
detention time including stored flow	=	3.00	hrs
sediment load discharged	=	76.62	tons
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC100-6

Rail Cut Pond 100yr 6 hr operational January 2011 X

```
       2         0
    2.05      6.00      .10      .00
       3         2
       2         2         1
    2.75      1.50     1.40
       2        15
 13.0000    2.0000    .4250    .2500    .1500    .0750    .0500    .0300    .0200    .0100
   .0080      .0060    .0040    .0020    .0001
   94.30     83.70     78.00    73.30    66.30    45.00    34.00    26.30    20.30    15.00
   13.80     12.30     11.00    10.00      .00
   75.00     60.00     50.00    40.00    30.00    20.00    10.00     8.00     7.00     6.00
    5.00      4.00      3.00     1.00      .00
       2         1
    .000      .000      .000     .150     .150     .350
    .000      .000      .000
       1         1
    .150      .150      .400
    .000      .000      .000
       1
    .100      .100      .350
       2         1         1        1        1
  13.000    75.000      .250     .000     .100     .350    1.000    1.000    .000
   .2000150.0000  20.0000    .9000  1.0000
  64.900    70.000      .600     .150     .150     .350    1.000    1.000    .000
   .2000500.0000    .5000    .9000  2.0000
       1         1         1        1        1
   3.100    78.000      .170     .000     .000     .000    1.000    1.000    .000
   .2000100.0000  45.0000  1.0000  1.0000
       1         1         1        1        1
  10.600    70.000      .400     .050     .050     .350    1.000    1.000    .000
   .2000  40.0000  35.0000    .9000  2.0000
       1         1         1        1        1
   3.900    78.000      .140     .000     .100     .350    1.000    1.000    .000
   .2000150.0000  33.0000  1.0000  1.0000
       1         1         1        1        1
   1.700    75.000      .070     .000     .020     .400    1.000    1.000    .000
   .2000100.0000  35.0000  1.0000  1.0000
       2         2         1        1        1
   4.300    74.000      .130     .080     .080     .350    1.000    1.000    .000
   .2000300.0000  37.0000  1.0000  1.0000
  12.200    70.000      .300     .000     .000     .000    1.000    1.000    .000
   .2000400.0000  35.0000  1.0000  1.0000
     .20      1.00     20.00
       3         0        13      500        1        1        2
     .00      1.00      2.00     3.00     4.00     5.00     5.34     5.40     5.50     5.60
    6.00      7.00      8.00
    .000      .170      .340     .460     .590     .700     .760     .770     .790     .800
    .870     1.040     1.270
     .00       .00       .01      .01      .01      .01      .01      .57     2.49     5.16
   20.89     25.00     30.00
```

APPENDIX 8-1

PERMIT TERM RECLAMATION PLAN
HYDROLOGY PLAN

A.	Pasture Pond	-	updated February 2007
B.	Coal Pile Sediment Pond	-	July 1994
C.	Coarse Refuse Toe Pond	-	July 1994
D.	Rail Cut Pond	-	Updated July 2011
E.	Old Coarse Refuse Road Pond	-	July 1994
F.	Borrow Area Pond	-	July 1994

REFERENCE

Plate 8-3

Hydrologic and sediment parameters

Diversion and Culvert Design Criteria

10 year, 6 hour storm - Phase 1
10 year, 24 hour storm - Phase 1
25 year, 6 hour storm - Phase 1
10 year, 6 hour storm - Phase 2
100 year, 6 hour storm - Phase 2

July 2011

RAILCUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

UPDES DISCHARGE 007
Reference Drawings 8-3, 7-8

Hydrologic and Sediment Parameters

10 year 6 hour storm – Phase 1
10 year 24 hour storm – Phase 1
25 year 6 hour storm – Phase 1
10 year 6 hour storm – Phase 2
100 year 6 hour storm – Phase 2

Diversion and culvert design criteria.

This appendix segment is a replacement for prior hydrologic calculations for the RailCut Pond - Permit Term Reclamation Plan. The Railcut Pond is adequate to receive runoff from the reclamation watershed as designed herein.

RAILCUT SEDIMENT POND - Hydrologic Calculations

INTRODUCTION

The RAILCUT Sediment Pond (UPDES 007) is located near the southwest corner of the permit area (see Plate 7-1). It collects drainage from the upper portion of the refuse pile and the industrial borrow area. The pond is an off channel, temporary sediment control structure, with a total as-built volume of approximately 4.8 acre-feet (top of bank). Surface water runoff and sediment runoff from a 109.1 acre watershed is captured by the pond.

The RAILCUT Pond has been in service for a number of decades. During the past several years, excavation of the Refuse Pile (including the former West and East Cells) has modified the drainage elevations such that these Cells are no longer impoundments and have been incorporated as part of the Refuse Pile. The new hydrologic modeling accompanying this appendix section includes the entire combined watershed now contributing to the Rail Cut Pond. These calculations supersede those previously presented in the Permit Term Reclamation Plan for the Rail Cut Pond drainages.

The drainage area contributing to the Rail Cut Pond would be reclaimed in Phase 1 with the pond remaining in place until reclamation in Phase 2 as shown on Plate 8-1. The phases of reclamation would occur as described in the approved permit.

The structure is a temporary pond as addressed in R645-301-732.200. The structure does not meet the size or other qualifying criteria of the MSHA of 30 CFR 77.216(a). Therefore, it provides a combination of principal and emergency spillways that will safely discharge a 25 year, 6 hour event.

The pond contains a 2 inch drain pipe. This 2 inch pipe is normally closed but can be opened to discharge the pond following major storm events after appropriate settling times. The pond is modeled in Sedimot-II with the pond essentially considered empty when the storm begins.

The pond can discharge through a 48 inch drop inlet spillway when the water level reaches the stage elevation of 6212.34 (5.34 feet deep). The 48 inch pipe spillway is capable of passing the 25 year, 6 hour peak flow. The pond treats the 10 year, 24 hour storm such that effluent is well within the UPDES limits.

Topsoil was removed prior to construction of the pond and is stored in a stockpile directly south of the pond. After the useful life of the pond, the area will be appropriately reclaimed.

SUBWATERSHEDS

The RAIL CUT Pond drainage area is divided into eight sub watersheds for routing analysis. These are labeled as follows: RC-SWS1, RC-SWS2, RC-SWS3, RC-SWS4, RC-SWS6, RC-SWS7, and RC-SWS8 (see Plate 8-3).

SOIL TYPE

According to the SCS Soil Survey of Carbon Area, Utah, the soil type found in this drainage area is predominantly SCS # 114, Strych. Three soil samples from the adjacent Reclamation Borrow Area were analyzed by Huntingdon/Chen-Northern in the early 1990s. The particle size distribution from these samples was plotted and averaged for use in sediment modeling. Due to the nature of the reclamation process, the Erosion Control Practice (CP) factors are higher when the site is first covered and reseeded in Phase One and Lower in Phase Two when the vegetation is more established. Other soil characteristics are as follows:

SCS Soil Name	Strych
Submerged Specific Gravity	1.75
Specific Gravity	2.75
Erosion K value	0.20
Bulk Density	1.4
CP Factor (phase 1)	0.9 to 1.0
CP Factor (phase 2)	0.25

CURVE NUMBERS

The RAIL CUT Pond curve numbers are based on the Soil Conservation Service graph. The soil types found on the site correspond to SCS hydrologic Class B as indicated in the SCS Soil Survey for Carbon Area, Utah. Due to the nature of the reclamation process, the percent vegetation cover will be negligible when the site is first covered and reseeded.

A curve number of 84 (corresponding to zero percent of vegetation cover density) is used for the areas covered with borrow material during phase one. A curve number of 69 (corresponding to 30 percent vegetation cover density is used for the phase two calculations. These proposed curve numbers are considered to be potentially very conservative given the plans concerning surface roughening which could dramatically reduce the percent of runoff from the sub watersheds. Appropriate curve numbers are used for undisturbed or previously reclaimed areas.

TIME OF CONCENTRATION

Each sub watershed requires a certain time for the water to reach the outlet following the longest path. The runoff from these sub watersheds is approximated by Sedimot-II "Disturbed" unit hydrograph for areas with poor vegetative cover. The overland flow velocity was estimated using the Soil Conservation Service Upland Curves (SCS 1972) corresponding to the slope and vegetation of the drainage areas. Time of concentration was calculated by dividing the average velocity into the distance to the sub watershed outlet.

SUB WATERSHED CHARACTERISTICS

SubWatershed	SCS Hydrologic Class	PH 1 Vegetation Cover Density	Phase 1 Curve No	Phase 2 Vegetation Cover Density	Phase 2 Curve No	Area (acres)	Distance to Outlet	Average Velocity (ft/s)	Time of Concentration (hrs)
RC-SWS1	B	0%	84	30%	69	42.6	2000	1.1	0.50
RC-SWS2	B	0%	84	30%	69	13.5	1550	1.7	0.25
RC-SWS3	B	0%	84	30%	69	11.2	2000	1.3	0.43
RC-SWS4	B	0%	84	30%	69	18.3	2000	1.6	0.35
RC-SWS5	B	0%	84	30%	69	3.7	1000	1.7	0.16
RC-SWS6	B	0%	84	30%	69	1.6	600	2.4	0.07
RC-SWS7	B	30%	70	30%	69	4.3	800	1.7	0.13
RC-SWS8	B	30%	70	30%	69	13.9	1800	1.6	0.31

ROUTING COEFFICIENTS

"Sedimot-II" uses Muskingum routing methods. Flows must be routed between structures or from a subwatershed outlet to the corresponding structure (if the outlet is not at the structure). No routing is used through sub watersheds that do not have inflow from a previous watershed, or structure (this water flow is accounted for with the time of concentration and the unit hydrograph). Areas requiring routing coefficients are indicated in the program output data. Muskingum coefficients K and X are used as follows:

K = Travel time through diversion.

$$X = \frac{0.5^* \text{ Velocity}}{1.7 + \text{Velocity}}$$

STORM RUNOFF VOLUMES AND DESIGN FLOWS

Storm Event	Total Runoff (acft)	Total Sediment (tons)	Pond Stage Elevation	RD3 cfs	RD4 cfs	RD5 &RD6 cfs	RD7 cfs	RD8 cfs	RD9 cfs	RD10 cfs	RD11 cfs	RD12 cfs
10yr 6hr ph 1	2.4	922	6212.36	**11.4**	**5.0**	**3.2**	**5.8**	**7.8**	**1.6**	**0.9**	**8.3**	**8.6**
10yr 24hr ph 1	5.1	1937	6212.48	17.8	7.4	5.0	9.0	12.3	2.3	1.1	13.2	14.2
25yr 6 hr ph 1	3.9	1719	6212.41	19.0	8.2	5.4	9.7	13.3	2.6	1.3	13.5	14.7
10yr 6 hr ph 2	0.3	48	6209.0	0.6	0.2	0.2	0.3	0.4	0.1	0.0	0.5	0.8
100yr 6hr ph 2	2.1	296	6212.3	7.3	3.3	2.1	3.8	4.6	1.1	0.7	5.1	7.4
Operational design	2.8	1314	6212.6		**6.3**	**2.3**	**13.7**	**15.0**	**2.9**	**1.2**	**15.7**	**17.2**

The results of the hydrologic modeling for the reclamation condition are shown above for the different storms. For comparison, the flow rates used for the operational design condition are also shown.

The flowline of the primary discharge (decant) pipe (and 100% sediment storage) is at elevation 6209.07. Sediment levels in the pond are allowed to fill to 60% of sediment capacity (6207.7) prior to a required cleaning. Adequate storage exists to treat the calculated storm runoff volumes and the projected sediment volume from the modeled storms.

The permittee is encouraged to perform the periodic cleaning to elevations lower than the minimum design depth to allow for additional sedimentation storage between cleaning events.

The phase 1 storms are projected to have a small discharge from the pond. Detention time for these storms is modeled to be over 2 hours. This is expected to be adequate to allow settling to occur in the pond adequate to meet the UPDES discharge concentration volumes.

DIVERSION DESIGN

Diversions within this watershed are designed for the larger of two storms: 10 year 6 hour storm during the temporary phase one condition or the 100 year 6 hour storm during the phase two condition. Since the phase one conditions were modeled without consideration of the surface roughening factors and therefore using the high runoff curve numbers, the 10 year 6 hour condition projects the higher flow rates and was used for design purposes.

Design summaries are given in the tables below. The diversions were designed to fit within a range of expected field values. The flow depth and flow area are calculated by using the average channel slope and an assumed channel cross section. Due to the reality

that the channel conditions will vary in the field, the critical value is to provide the minimum required cross sectional flow area for the storm flows to pass. Additional freeboard is not required in the regulations, but we have recommended that the operator may construct the diversions larger than required to reduce the risk of overflow from conditions not assumed in this hydrologic model.

DIVERSION DESIGN CRITERIA

Ditch No.	Manning N	Side Slope minH/1V	Min Bottom Width (ft)	Design Flow (cfs)	Channel Slope Avg %	Flow Depth ft	Flow Area sqft	Velocity (ft/s)	Min Channel Depth (ft)	Comments
RC-RD3	0.035	2	1	**11.4**	1	1.13	3.39	3.4	1.6	No lining required
RC-RD4	0.035	2	1	**5.0**	5	0.30	0.90	5.6	0.8	Lining reqd slopes over 4%
RC-RD5	0.035	2	0	**3.2**	2	0.40	0.80	4.1	0.9	No lining required
RC-RD6	0.035	2	1	**3.2**	33	0.11	0.33	10.0	0.6	Lining reqd slopes over 4% or leave culvert in place
RC-RD7	0.035	2	1	**5.8**	0.5	0.85	2.55	2.2	1.4	No lining required
RC-RD8	0.035	2	1	**7.8**	33	0.20	0.60	13.0	0.7	Lining reqd slopes over 4% or leave culvert in place
RC-RD9	0.035	2	0	**1.6**	0.5	0.40	0.80	2.0	0.9	No lining required
RC-RD10	0.035	2	0	**0.9**	5	0.07	0.14	6.4	0.6	Lining reqd slopes over 4%
RC-RD11	0.035	2	1	**8.3**	2.5	0.58	1.74	4.8	1.1	No lining required
RC-RD12	0.035	2	3	**8.6**	0.4	0.77	3.85	2.2	1.3	No lining required

RIPRAP SIZING

Riprap is placed along steep channel slopes and at select culvert outlets to control erosion. The size of the stones is based on the expected maximum velocity of water flowing. When peak velocities in the smooth channel are expected to reach 5 ft/s, riprap is required. The operator may choose to add riprap in other channel areas where erosive conditions present a difficulty for the site. The riprap mixture should approximate the following gradation:

Stone Size	% Finer
$2*D_{50}$	100
D_{50}	50
$0.5*D_{50}$	20
$0.2*D_{50}$	0

In areas where the increased roughness from riprap does not reduce the velocity below 5 ft/s, a filter blanket (or gravel bedding in a layer $3*D_{50}$) may be used.

The velocity expected in the channel is calculated by dividing the flow rate by the flow cross sectional area. Manning's N for a channel bed with riprap is estimated by the equation $N=0.0395*(D_{50})^{1/6}$ with D_{50} in feet (Applied Hydrology and Sedimentology for Disturbed Areas page 188). If the normal depth of flow is less than twice D_{50} then N is estimated by the equation $N=0.456*(D_{50}$ *Slope) 0.159 with D_{50} in inches and slope in feet/feet (*Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase 1* May 1987, Colorado State University, prepared for Uranium Recovery Field Office and Division of Waste Management).

CULVERT DESIGN CRITERIA

Culvert No	Pipe Diameter (in)	Pipe Length (ft)	Pipe Slope %	Controlling Head Water (Ft)	Design Flow (cfs)	Design Velocity (ft/s)	Inlet / Outlet Conditions
RC-C1 RC-C2 RC-C3	36	150	33	<2	**<25**	<10	Inlet end section and outlet splash pool

The three culverts installed on the face of the refuse pile were constructed with a standard end section for inlet control and an energy dissipating splash pool at the outlet. The 36" culverts are clearly overdesigned for the operational conditions under the regulations but the permittee wished to minimize the potential for problems from flows greater than anticipated at the time of installation. We recommend that since these culverts have been designed and installed adequate to meet permanent conditions, that they should be left in place after reclamation to reduce the potential for erosion on the face of the reclaimed pile.

RAIL CUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

10 Year 6 Hour Storm Hydrologic Model

Phase 1

****
****

University of Kentucky computer model
of surface mine hydrology and sedimentology
for more information contact the Agricultural
Engineering Department

the UK model is a design model developed to predict
the hydraulic and sediment response from surface
mined lands for a specified rainfall event (single storm)

version date 9-23-83

disclaimer: neither the University nor any of its employees
accept any responsibility or legal liability for the
conclusions drawn from the results of this model

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*
* the following values are now predicted by SEDIMOT II.
* they can be found in summary tables.
*   1. period of significant concentration
*   2. volume weighted average settleable concentration
*   during period of significant concentration
*   3. volume weighted average settleable concentration
*   during peak 24 hour period
*   4. arithmetic average settleable concentration during
*   period of significant concentration
*   5. arithmetic average settleable concentration
*   during peak 24 hour period
*
* all concentrations are in ml/l.
*
****

****

watershed identification code

Rail Cut Pond 10yr 6 hr permit term recl ph1 July 2011

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input particle size-percent finer distributions
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size,mm	13.000	2.000	.425	.250	.150	.075
	.050	.030	.020	.010	.008	.006
	.004	.002	.000			
pct finer no. 1	94.300	83.700	78.000	73.300	66.300	45.000
	34.000	26.300	20.300	15.000	13.800	12.300
	11.000	10.000	.000			

**********input values**********

storm duration	= 6.00	hours
precipation depth	= 1.31	inches
specific gravity	= 2.75	
load rate exponent factor	= 1.50	
submerged bulk specific gravity	= 1.40	

* *
junction 1, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
SWS-1	42.60	84.00	.500	.000	.100	.35	1.0
Sws-2	13.50	84.00	.250	.150	.150	.35	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	500.0	.50	.900	1.0	.0
2	1	.20	150.0	20.00	.900	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
RC-RD3 1	11.40	.30	11.12	.047	.658	1.000
RC-RD4 2	5.01	.30	127.75	.061	.790	.964

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****
---

runoff volume	=	1.4239	acre-ft
peak discharge	=	14.2521	cfs
area	=	56.1000	acres
time of peak discharge	=	3.30	hrs
beta	=	1.0000	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	152212.80	mg/l
peak settleable concentration	=	85.36	ml/l
peak settleable concentration	=	119509.70	mg/l
total sediment yield	=	134.2185	tons
representative particle size	=	.0571	mm
time of peak concentration	=	3.10	hrs
period of significant concentration	=	4.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	37.38	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	37.38	ml/l
arithmetic average settleable concentration during period of significant concentration	=	22.97	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	4.40	ml/l

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	6	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.300	.50	.00	.15
2.00	.600	1.25	.30	.60
3.00	.700	2.06	.60	1.25
4.00	.800	2.90	.90	2.00
5.50	.900	4.17	4.00	3.28

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.150	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	1.424	acre-ft
outflow routed volume	=	1.287	acre-ft
storm volume discharged (plug flow)	=	1.287	acre-ft
pond volume at peak stage	=	1.416	acre-ft
peak stage	=	3.222	ft
peak inflow rate	=	14.252	cfs
peak discharge rate	=	.667	cfs
peak inflow sediment concentration	=	152212.80	mg/l
peak effluent sediment concentration	=	31609.11	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.05	mg/l
storm average effluent concentration	=	8423.59	mg/l
average effluent sediment concentration	=	8423.59	mg/l
basin trap efficiency	=	88.99	percent
detention time of flow with sediment	=	15.72	hrs
detention time from hydrograph centers	=	15.72	hrs
detention time including stored flow	=	15.72	hrs
sediment load discharged	=	14.78	tons
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

1

* *
junction 1, branch 1, structure 2
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	18.30	84.00	.350	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	5.84	.30	614.94	.054	.727	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.4645	acre-ft
peak discharge	=	5.8400	cfs
area	=	18.3000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	965016.80	mg/l
peak settleable concentration	=	536.35	ml/l
peak settleable concentration	=	750894.70	mg/l
total sediment yield	=	614.9389	tons
representative particle size	=	.0545	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	4.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	387.26	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	387.26	ml/l
arithmetic average settleable concentration during period of significant concentration	=	273.27	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	47.82	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	.67	cfs
time of routed peak discharge	=	6.80	hrs

total drainage area	=	74.40	acres
total runoff volume	=	1.8884	ac-ft
peak runoff discharge	=	5.86	cfs RC-RD7
time to peak discharge	=	3.20	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	629.7218	tons
peak sediment concentration	=	963022.90	mg/l
peak settleable concentration	=	522.4935	ml/l
peak settleable concentration	=	731490.90	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	105.96	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	131.93	ml/l
arithmetic average settleable concentration during period of significant concentration	=	21.64	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	39.11	ml/l

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null structure
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junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	11.20	84.00	.430	.050	.050	.35	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
RC-RD5&6 1	3.24	.30	109.79	.051	.687	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.2843	acre-ft
peak discharge	=	3.2372	cfs
area	=	11.2000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	367962.40	mg/l
peak settleable concentration	=	201.37	ml/l
peak settleable concentration	=	281924.20	mg/l
total sediment yield	=	109.7760	tons
representative particle size	=	.0507	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	4.40	hrs
volume weighted average settleable concentration during period of significant concentration	=	138.81	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	138.81	ml/l
arithmetic average settleable concentration during period of significant concentration	=	92.54	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	16.97	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
Sws-5 1	3.70	84.00	.160	.000	.100	.35	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
RC-RD9 1	1.60	.30	87.95	.070	.863	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0939	acre-ft
peak discharge	=	1.4874	cfs
area	=	3.7000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	781478.10	mg/l
peak settleable concentration	=	452.94	ml/l
peak settleable concentration	=	634117.10	mg/l
total sediment yield	=	87.9526	tons
representative particle size	=	.0700	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	305.85	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	305.85	ml/l
arithmetic average settleable concentration during period of significant concentration	=	219.90	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	33.90	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	7.85	cfs RC-RD8
time of routed peak discharge	=	3.40	hrs
total drainage area	=	89.30	acres
total runoff volume	=	2.2666	ac-ft
peak runoff discharge	=	8.56	cfs
time to peak discharge	=	3.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	827.1966	tons
peak sediment concentration	=	752762.60	mg/l
peak settleable concentration	=	411.8014	ml/l
peak settleable concentration	=	576522.00	mg/l
time to peak concentration	=	3.40	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	123.26	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	147.36	ml/l
arithmetic average settleable concentration during period of significant concentration	=	19.97	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	35.80	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.60	84.00	.070	.000	.020	.40	.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
RC-RD10 1	.86	.30	33.88	.088	1.000	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0406	acre-ft
peak discharge	=	.8616	cfs
area	=	1.6000	acres
time of peak discharge	=	3.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	765638.40	mg/l
peak settleable concentration	=	457.45	ml/l
peak settleable concentration	=	640429.80	mg/l
total sediment yield	=	33.8773	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.00	hrs
period of significant concentration	=	3.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	294.56	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	294.56	ml/l
arithmetic average settleable concentration during period of significant concentration	=	210.03	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	27.13	ml/l

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null structure
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junction 3, branch 1, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	70.00	.130	.080	.080	.35	1.0
2	13.90	70.00	.310	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.10	.04	12.90	.052	.706	1.000
2	.30	.04	48.49	.047	.664	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0656	acre-ft
peak discharge	=	.3973	cfs
area	=	18.2000	acres
time of peak discharge	=	3.70	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	649058.40	mg/l
peak settleable concentration	=	352.99	ml/l
peak settleable concentration	=	494183.40	mg/l
total sediment yield	=	61.3915	tons
representative particle size	=	.0488	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	295.88	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	295.88	ml/l
arithmetic average settleable concentration during period of significant concentration	=	267.55	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	41.25	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	8.31	cfs RC-RD11
time of routed peak discharge	=	3.40	hrs
total drainage area	=	109.10	acres
total runoff volume	=	2.3729	ac-ft
peak runoff discharge	=	8.58	cfs RC-RD12
time to peak discharge	=	3.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1000	hrs
total sediment yield	=	922.2641	tons
peak sediment concentration	=	724414.00	mg/l
peak settleable concentration	=	397.4351	ml/l
peak settleable concentration	=	556409.10	mg/l
time to peak concentration	=	3.40	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	132.48	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	157.10	ml/l
arithmetic average settleable concentration during period of significant concentration	=	22.11	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	39.99	ml/l

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pond results

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***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.373	acre-ft
outflow routed volume	=	.227	acre-ft
storm volume discharged (plug flow)	=	.227	acre-ft
pond volume at peak stage	=	2.171	acre-ft
peak stage	=	5.356	ft
peak inflow rate	=	8.582	cfs
peak discharge rate	=	.163	cfs outlet
peak inflow sediment concentration	=	724414.00	mg/l
peak effluent sediment concentration	=	177638.60	mg/l
peak effluent settleable concentration	=	.0002	ml/l
peak effluent settleable concentration	=	.26	mg/l
storm average effluent concentration	=	61688.31	mg/l
average effluent sediment concentration	=	61688.31	mg/l
basin trap efficiency	=	98.04	percent
detention time of flow with sediment	=	33.05	hrs
detention time from hydrograph centers	=	33.05	hrs
detention time including stored flow	=	33.05	hrs
sediment load discharged	=	18.03	tons
period of significant concentration	=	97.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC10-6

Rail Cut Pond 10yr 6 hr permit term recl ph1 Jan 2011 X

```
     2        0
  1.31     6.00      .10      .00
     3        2
     2        2         1
  2.75     1.50     1.40
     1       15
 13.0000  2.0000   .4250   .2500   .1500   .0750   .0500   .0300   .0200   .0100
  .0080    .0060   .0040   .0020   .0001
 94.30    83.70    78.00   73.30   66.30   45.00   34.00   26.30   20.30   15.00
 13.80    12.30    11.00   10.00     .00
     2        1
  .000     .000     .000    .150    .150    .350
  .000     .000     .000
     1        1
  .150     .150     .400
  .000     .000     .000
     1
  .100     .100     .350
     2        2        1       1       1
 42.600   84.000    .500    .000    .100    .350   1.000   1.000    .000
  .2000500.0000    .5000   .9000  1.0000
 13.500   84.000    .250    .150    .150    .350   1.000   1.000    .000
  .2000150.0000  20.0000   .9000  1.0000
   .20     1.00    20.00
     3        0        6     500       1       1       2
  .00     1.00     2.00    3.00    4.00    5.50
 .000     .300     .600    .700    .800    .900
  .00      .00      .30     .60     .90    4.00
     1        1        1       1       1
 18.300   84.000    .350    .000    .000    .000   1.000   1.000    .000
  .2000100.0000  45.0000  1.0000  1.0000
     1        1        1       1       1
 11.200   84.000    .430    .050    .050    .350   1.000   1.000    .000
  .2000 40.0000  35.0000   .9000  1.0000
     1        1        1       1       1
  3.700   84.000    .160    .000    .100    .350   1.000   1.000    .000
  .2000150.0000  33.0000  1.0000  1.0000
     1        1        1       1       1
  1.600   84.000    .070    .000    .020    .400   1.000   1.000    .000
  .2000100.0000  35.0000  1.0000  1.0000
     2        2        1       1       1
  4.300   70.000    .130    .080    .080    .350   1.000   1.000    .000
  .2000300.0000  37.0000  1.0000  1.0000
 13.900   70.000    .310    .000    .000    .000   1.000   1.000    .000
  .2000400.0000  35.0000  1.0000  1.0000
   .20     1.00    20.00
     3        0       13     500       1       1       2
  .00     1.00     2.00    3.00    4.00    5.00    5.34    5.40    5.50    5.60
 6.00     7.00     8.00
 .000     .170     .340    .460    .590    .700    .760    .770    .790    .800
 .870    1.040    1.270
  .00      .00      .01     .01     .01     .01     .01     .57    2.49    5.16
20.89    25.00    30.00
```

RAIL CUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

10 Year 24 Hour Storm Hydrologic Model

Phase 1

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****

University of Kentucky computer model
of surface mine hydrology and sedimentology
for more information contact the Agricultural
Engineering Department

the UK model is a design model developed to predict
the hydraulic and sediment response from surface
mined lands for a specified rainfall event (single storm)

version date 9-23-83

disclaimer: neither the University nor any of its employees
accept any responsibility or legal liability for the
conclusions drawn from the results of this model

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* *
* the following values are now predicted by SEDIMOT II. *
* they can be found in summary tables. *
* 1. period of significant concentration *
* 2. volume weighted average settleable concentration *
* during period of significant concentration *
* 3. volume weighted average settleable concentration *
* during peak 24 hour period *
* 4. arithmetic average settleable concentration during *
* period of significant concentration *
* 5. arithmetic average settleable concentration *
* during peak 24 hour period *
* *
* all concentrations are in ml/l. *
* *
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watershed identification code

Rail Cut Pond 10yr 24 hr permit term recl July 2011

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input particle size-percent finer distributions
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size,mm	13.000	2.000	.425	.250	.150	.075
	.050	.030	.020	.010	.008	.006
	.004	.002	.000			
pct finer no. 1	94.300	83.700	78.000	73.300	66.300	45.000
	34.000	26.300	20.300	15.000	13.800	12.300
	11.000	10.000	.000			

**********input values**********

storm duration	=	24.00	hours
precipation depth	=	1.84	inches
specific gravity	=	2.75	
load rate exponent factor	=	1.50	
submerged bulk specific gravity	=	1.40	

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junction 1, branch 1, structure 1
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SWS 1
SWS2

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	42.60	84.00	.500	.000	.100	.35	1.0
2	13.50	84.00	.250	.150	.150	.35	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	500.0	.50	.900	1.0	.0
2	1	.20	150.0	20.00	.900	1.0	.0

RD3
RD4

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	17.78	.63	21.49	.056	.741	1.000
2	7.41	.63	239.67	.070	.864	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****
---

runoff volume	=	2.9586	acre-ft
peak discharge	=	24.0962	cfs
area	=	56.1000	acres
time of peak discharge	=	12.30	hrs
beta	=	.0100	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	134772.30	mg/l
peak settleable concentration	=	77.90	ml/l
peak settleable concentration	=	109063.10	mg/l
total sediment yield	=	261.0673	tons
representative particle size	=	.0687	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	14.50	hrs
volume weighted average settleable concentration during period of significant concentration	=	36.06	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	36.06	ml/l
arithmetic average settleable concentration during period of significant concentration	=	16.71	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	10.10	ml/l

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pond results

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***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	6	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.300	.50	.00	.15
2.00	.600	1.25	.30	.60
3.00	.700	2.06	.60	1.25
4.00	.800	2.90	.90	2.00
5.50	.900	4.17	4.00	3.28

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.150	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.959	acre-ft
outflow routed volume	=	2.350	acre-ft
storm volume discharged (plug flow)	=	2.350	acre-ft
pond volume at peak stage	=	2.129	acre-ft
peak stage	=	4.152	ft
peak inflow rate	=	24.096	cfs
peak discharge rate	=	1.215	cfs
peak inflow sediment concentration	=	134772.30	mg/l
peak effluent sediment concentration	=	28654.97	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.04	mg/l
storm average effluent concentration	=	7891.06	mg/l
average effluent sediment concentration	=	7891.06	mg/l
basin trap efficiency	=	90.31	percent
detention time of flow with sediment	=	13.08	hrs
detention time from hydrograph centers	=	13.08	hrs
detention time including stored flow	=	13.08	hrs
sediment load discharged	=	25.31	tons
period of significant concentration	=	38.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

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junction 1, branch 1, structure 2
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S005 4

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	18.30	84.00	.350	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	8.90	.63	1172.46	.063	.807	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.9651	acre-ft
peak discharge	=	8.8978	cfs
area	=	18.3000	acres
time of peak discharge	=	12.10	hrs
beta	=	.0100	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	1033687.00	mg/l
peak settleable concentration	=	590.17	ml/l
peak settleable concentration	=	826244.40	mg/l
total sediment yield	=	1172.4550	tons
representative particle size	=	.0632	mm
time of peak concentration	=	12.10	hrs
period of significant concentration	=	14.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	360.85	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	360.85	ml/l
arithmetic average settleable concentration during period of significant concentration	=	201.54	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	118.41	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	1.21	cfs
time of routed peak discharge	=	20.40	hrs
total drainage area	=	74.40	acres
total runoff volume	=	3.9237	ac-ft
peak runoff discharge	=	9.00	cfs
time to peak discharge	=	12.20	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	1197.7640	tons
peak sediment concentration	=	1026468.00	mg/l
peak settleable concentration	=	573.5071	ml/l
peak settleable concentration	=	802909.90	mg/l
time to peak concentration	=	12.20	hrs
period of significant concentration	=	38.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	108.94	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	133.44	ml/l
arithmetic average settleable concentration during period of significant concentration	=	38.61	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	60.39	ml/l

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null structure
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junction 1, branch 2, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	11.20	84.00	.430	.050	.050	.35	1.0

SWS 3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	5.00	.63	210.91	.059	.770	1.000

RD 5+6

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.5907	acre-ft
peak discharge	=	4.9992	cfs
area	=	11.2000	acres
time of peak discharge	=	12.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	407859.30	mg/l
peak settleable concentration	=	230.12	ml/l
peak settleable concentration	=	322169.40	mg/l
total sediment yield	=	210.8851	tons
representative particle size	=	.0590	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	14.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	131.47	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	131.47	ml/l
arithmetic average settleable concentration during period of significant concentration	=	68.27	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	40.11	ml/l

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null structure
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junction 2, branch 1, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.70	84.00	.160	.000	.100	.35	1.0

SWS 5

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.26	.63	160.65	.077	.918	1.000

RD 9

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1951	acre-ft
peak discharge	=	2.1254	cfs
area	=	3.7000	acres
time of peak discharge	=	12.20	hrs
beta	=	.0102	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	806053.60	mg/l
peak settleable concentration	=	473.49	ml/l
peak settleable concentration	=	662879.30	mg/l
total sediment yield	=	160.6513	tons
representative particle size	=	.0773	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	13.40	hrs
volume weighted average settleable concentration during period of significant concentration	=	271.85	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	271.85	ml/l
arithmetic average settleable concentration during period of significant concentration	=	145.39	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	81.18	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	12.32	cfs
time of routed peak discharge	=	12.40	hrs
total drainage area	=	89.30	acres
total runoff volume	=	4.7095	ac-ft
peak runoff discharge	=	13.24	cfs
time to peak discharge	=	12.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	1568.7670	tons
peak sediment concentration	=	809799.60	mg/l
peak settleable concentration	=	455.3875	ml/l
peak settleable concentration	=	637542.60	mg/l
time to peak concentration	=	12.40	hrs
period of significant concentration	=	38.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	123.81	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	145.59	ml/l
arithmetic average settleable concentration during period of significant concentration	=	36.72	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	57.32	ml/l

RD 8

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null structure
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junction 2, branch 2, structure 1
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*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.60	84.00	.070	.000	.020	.40	.0

SWS 6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.11	.63	58.80	.088	1.000	1.000

RD 10

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0844	acre-ft
peak discharge	=	1.1102	cfs
area	=	1.6000	acres
time of peak discharge	=	12.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	745448.60	mg/l
peak settleable concentration	=	445.39	ml/l
peak settleable concentration	=	623541.70	mg/l
total sediment yield	=	58.8027	tons
representative particle size	=	.0883	mm
time of peak concentration	=	12.00	hrs
period of significant concentration	=	12.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	245.87	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	245.87	ml/l
arithmetic average settleable concentration during period of significant concentration	=	124.49	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	65.87	ml/l

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null structure
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junction 3, branch 1, structure 1
* *

SWS7
SWS8

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	70.00	.130	.080	.080	.35	1.0
2	13.90	70.00	.310	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.51	.18	70.39	.058	.757	1.000
2	1.23	.18	240.19	.045	.647	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.2781	acre-ft
peak discharge	=	1.6638	cfs
area	=	18.2000	acres
time of peak discharge	=	12.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	18.15	ei unit
peak concentration	=	1011144.00	mg/l
peak settleable concentration	=	548.98	ml/l
peak settleable concentration	=	768578.00	mg/l
total sediment yield	=	310.5601	tons
representative particle size	=	.0482	mm
time of peak concentration	=	12.20	hrs
period of significant concentration	=	12.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	329.75	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	329.75	ml/l
arithmetic average settleable concentration during period of significant concentration	=	260.05	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	139.78	ml/l

summary table of combined hydrograph and sedigraph values

RC 2011
RD 12

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	13.17	cfs
time of routed peak discharge	=	12.40	hrs
total drainage area	=	109.10	acres
total runoff volume	=	5.0720	ac-ft
peak runoff discharge	=	14.18	cfs
time to peak discharge	=	12.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1000	hrs
total sediment yield	=	1937.7210	tons
peak sediment concentration	=	795728.40	mg/l
peak settleable concentration	=	445.7848	ml/l
peak settleable concentration	=	624098.80	mg/l
time to peak concentration	=	12.40	hrs
period of significant concentration	=	38.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	140.82	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	163.41	ml/l
arithmetic average settleable concentration during period of significant concentration	=	43.78	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	68.74	ml/l

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	5.072	acre-ft
outflow routed volume	=	2.771	acre-ft
storm volume discharged (plug flow)	=	2.771	acre-ft
pond volume at peak stage	=	2.268	acre-ft
peak stage	=	5.482	ft
peak inflow rate	=	14.179	cfs
peak discharge rate	=	2.145	cfs outlet
peak inflow sediment concentration	=	795728.40	mg/l
peak effluent sediment concentration	=	199020.30	mg/l
peak effluent settleable concentration	=	.0002	ml/l
peak effluent settleable concentration	=	.29	mg/l
storm average effluent concentration	=	62882.70	mg/l
average effluent sediment concentration	=	62882.70	mg/l
basin trap efficiency	=	89.21	percent
detention time of flow with sediment	=	8.44	hrs
detention time from hydrograph centers	=	8.44	hrs
detention time including stored flow	=	8.44	hrs
sediment load discharged	=	209.01	tons
period of significant concentration	=	88.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC1024

Rail Cut Pond 10yr 24 hr permit term recl Jan 2011 X

```
      2         0
   1.84     24.00      .10      .00
      3         2
      2         2         1
   2.75      1.50     1.40
      1        15
13.0000   2.0000    .4250    .2500    .1500    .0750    .0500    .0300    .0200    .0100
  .0080    .0060    .0040    .0020    .0001
 94.30    83.70    78.00    73.30    66.30    45.00    34.00    26.30    20.30    15.00
 13.80    12.30    11.00    10.00      .00
      2         1
  .000     .000     .000     .150     .150     .350
  .000     .000     .000
      1         1
  .150     .150     .400
  .000     .000     .000
      1
  .100     .100     .350
      2         2         1         1         1
42.600   84.000     .500     .000     .100     .350    1.000    1.000     .000
 .2000500.0000    .5000    .9000  1.0000
13.500   84.000     .250     .150     .150     .350    1.000    1.000     .000
 .2000150.0000  20.0000    .9000  1.0000
   .20     1.00    20.00
      3         0         6       500         1         1         2
  .00     1.00     2.00     3.00     4.00     5.50
 .000     .300     .600     .700     .800     .900
  .00      .00      .30      .60      .90     4.00
      1         1         1         1         1
18.300   84.000     .350     .000     .000     .000    1.000    1.000     .000
 .2000100.0000  45.0000  1.0000  1.0000
      1         1         1         1         1
11.200   84.000     .430     .050     .050     .350    1.000    1.000     .000
 .2000 40.0000  35.0000    .9000  1.0000
      1         1         1         1         1
 3.700   84.000     .160     .000     .100     .350    1.000    1.000     .000
 .2000150.0000  33.0000  1.0000  1.0000
      1         1         1         1         1
 1.600   84.000     .070     .000     .020     .400    1.000    1.000     .000
 .2000100.0000  35.0000  1.0000  1.0000
      2         2         1         1         1
 4.300   70.000     .130     .080     .080     .350    1.000    1.000     .000
 .2000300.0000  37.0000  1.0000  1.0000
13.900   70.000     .310     .000     .000     .000    1.000    1.000     .000
 .2000400.0000  35.0000  1.0000  1.0000
   .20     1.00    20.00
      3         0        13       500         1         1         2
  .00     1.00     2.00     3.00     4.00     5.00     5.34     5.40     5.50     5.60
 6.00     7.00     8.00
 .000     .170     .340     .460     .590     .700     .760     .770     .790     .800
 .870    1.040    1.270
  .00      .00      .01      .01      .01      .01      .01      .57     2.49     5.16
20.89    25.00    30.00
```

RAIL CUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

25 Year 6 Hour Storm Hydrologic Model

Phase 1

```
*****************************************************************
*****************************************************************

       University of Kentucky computer model
       of surface mine hydrology and sedimentology
       for more information contact the Agricultural
       Engineering Department

       the UK model is a design model developed to predict
       the hydraulic and sediment response from surface
       mined lands for a specified rainfall event (single storm)

       version date 9-23-83

       disclaimer: neither the University nor any of its employees
       accept any responsibility or legal liability for the
       conclusions drawn from the results of this model

*****************************************************************
*****************************************************************


*****************************************************************
*                                                               *
*     the following values are now predicted by SEDIMOT II.     *
*     they can be found in summary tables.                      *
*      1. period of significant concentration                   *
*      2. volume weighted average settleable concentration      *
*         during period of significant concentration            *
*      3. volume weighted average settleable concentration      *
*         during peak 24 hour period                            *
*      4. arithmetic average settleable concentration during    *
*         period of significant concentration                   *
*      5. arithmetic average settleable concentration           *
*         during peak 24 hour period                            *
*                                                               *
*     all concentrations are in ml/l.                           *
*                                                               *
*****************************************************************


            *******************************************

                 watershed identification code
                 -----------------------------
                 Rail Cut Pond  25yr 6 hr  permit term recl ph1 July 2011

            *******************************************


           input particle size-percent finer distributions
            ----------------------------------------------


size,mm           13.000  2.000   .425   .250   .150   .075
                    .050   .030   .020   .010   .008   .006
                    .004   .002   .000
pct finer no. 1   94.300 83.700 78.000 73.300 66.300 45.000
                  34.000 26.300 20.300 15.000 13.800 12.300
                  11.000 10.000   .000


  ********************input values**********************

  storm duration                    =       6.00   hours
  precipation depth                 =       1.62   inches
  specific gravity                  =       2.75
  load rate exponent factor         =       1.50
  submerged bulk specific gravity   =       1.40
```



```
* * * * * * * * * * * * * * * * * * * * * * * *
   junction  1, branch  1, structure  1
* * * * * * * * * * * * * * * * * * * * * * * *


          *** hydraulic input values for subwatersheds ***

water    area     curve      tc      tt    routing coefficients    unit
shed     acres    number     hr      hr        k-hrs        x      hydro
-------------------------------------------------------------------------
  1      42.60    84.00     .500    .000       .100        .35     1.0
  2      13.50    84.00     .250    .150       .150        .35     1.0

          *** sediment input values for subwatersheds ***

water    seg      soil       length      slope     cp       part     surf
shed     num       k          feet        pct     value     opt      cond
-------------------------------------------------------------------------
  1       1       .20        500.0        .50     .900      1.0      .0
  2       1       .20        150.0      20.00     .900      1.0      .0

          * * * computed values for individual watersheds * * *

watershed   peak flow    runoff     sediment    diam     delivery   delivery
             (cfs)     (inches)      tons       (mm)     ratio 1    ratio 2
-------------------------------------------------------------------------
  1          18.95        .49        19.26      .051      .689      1.000
  2           8.17        .49       218.96      .064      .818      1.000

note:  sediment does not include possible deposition by delivery ratio 2


          ***** summary table for total watershed *****
          -------------------------------------------

runoff volume                          =      2.2830   acre-ft
peak discharge                         =     25.0423   cfs
area                                   =     56.1000   acres
time of peak discharge                 =        3.30   hrs
beta                                   =       .0100
rainfall erositivity factor            =       24.10   ei unit
peak concentration                     =   141748.60   mg/l
peak settleable concentration          =      80.89    ml/l
peak settleable concentration          =   113241.00   mg/l
total sediment yield                   =     238.1411  tons
representative particle size           =       .0630   mm
time of peak concentration             =        3.20   hrs
period of significant concentration=           4.70   hrs
volume weighted average settleable
  concentration during period of
  significant concentration            =      42.00    ml/l
volume weighted average settleable
  concentration during peak 24 hour
  period                               =      42.00    ml/l
arithmetic average settleable
  concentration during period of
  significant concentration            =      23.53    ml/l
arithmetic average settleable
  concentration during peak 24 hour
  period                               =       4.61    ml/l
```

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	6	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.300	.50	.00	.15
2.00	.600	1.25	.30	.60
3.00	.700	2.06	.60	1.25
4.00	.800	2.90	.90	2.00
5.50	.900	4.17	4.00	3.28

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.150	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.283	acre-ft
outflow routed volume	=	2.034	acre-ft
storm volume discharged (plug flow)	=	2.034	acre-ft
pond volume at peak stage	=	2.175	acre-ft
peak stage	=	4.205	ft
peak inflow rate	=	25.042	cfs
peak discharge rate	=	1.324	cfs
peak inflow sediment concentration	=	141748.60	mg/l
peak effluent sediment concentration	=	39226.59	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.06	mg/l
storm average effluent concentration	=	9388.74	mg/l
average effluent sediment concentration	=	9388.74	mg/l
basin trap efficiency	=	89.06	percent
detention time of flow with sediment	=	16.20	hrs
detention time from hydrograph centers	=	16.20	hrs
detention time including stored flow	=	16.20	hrs
sediment load discharged	=	26.05	tons
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

SWS4

* *
junction 1, branch 1, structure 2
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	18.30	84.00	.350	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	9.64	.49	1060.52	.058	.757	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.7447	acre-ft
peak discharge	=	9.6393	cfs
area	=	18.3000	acres
time of peak discharge	=	3.10	hrs
beta	=	.0100	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	1003140.00	mg/l
peak settleable concentration	=	563.59	ml/l
peak settleable concentration	=	789027.00	mg/l
total sediment yield	=	1060.5150	tons
representative particle size	=	.0576	mm
time of peak concentration	=	3.10	hrs
period of significant concentration	=	4.30	hrs
volume weighted average settleable concentration during period of significant concentration	=	411.13	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	411.13	ml/l
arithmetic average settleable concentration during period of significant concentration	=	278.22	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	49.85	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	1.31	cfs
time of routed peak discharge	=	6.60	hrs
total drainage area	=	74.40	acres
total runoff volume	=	3.0277	ac-ft
peak runoff discharge	=	9.70	cfs
time to peak discharge	=	3.20	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	1086.5680	tons
peak sediment concentration	=	999397.80	mg/l
peak settleable concentration	=	547.8507	ml/l
peak settleable concentration	=	766991.00	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	113.48	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	143.45	ml/l
arithmetic average settleable concentration during period of significant concentration	=	22.59	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	40.52	ml/l

RC-RD7

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

* *
junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	11.20	84.00	.430	.050	.050	.35	1.0

SWS3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.900	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	5.37	.49	189.90	.054	.718	1.000

RC-RD5x6

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.4558	acre-ft
peak discharge	=	5.3717	cfs
area	=	11.2000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	390446.80	mg/l
peak settleable concentration	=	216.32	ml/l
peak settleable concentration	=	302849.80	mg/l
total sediment yield	=	189.8802	tons
representative particle size	=	.0536	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	4.40	hrs
volume weighted average settleable concentration during period of significant concentration	=	150.18	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	150.18	ml/l
arithmetic average settleable concentration during period of significant concentration	=	97.57	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	17.89	ml/l

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.70	84.00	.160	.000	.100	.35	1.0

SWS5

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.60	.49	150.01	.073	.889	1.000

RC-RD9

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1506	acre-ft
peak discharge	=	2.4191	cfs
area	=	3.7000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	806236.30	mg/l
peak settleable concentration	=	470.32	ml/l
peak settleable concentration	=	658448.40	mg/l
total sediment yield	=	150.0059	tons
representative particle size	=	.0735	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	322.63	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	322.63	ml/l
arithmetic average settleable concentration during period of significant concentration	=	226.56	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	34.93	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	13.28	cfs
time of routed peak discharge	=	3.40	hrs
total drainage area	=	89.30	acres
total runoff volume	=	3.6340	ac-ft
peak runoff discharge	=	14.38	cfs
time to peak discharge	=	3.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	1426.0040	tons
peak sediment concentration	=	786801.20	mg/l
peak settleable concentration	=	434.7914	ml/l
peak settleable concentration	=	608707.90	mg/l
time to peak concentration	=	3.40	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	132.20	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	159.87	ml/l
arithmetic average settleable concentration during period of significant concentration	=	21.04	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	37.44	ml/l

RC-R08

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 2, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.60	84.00	.070	.000	.020	.40	.0

SWS6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.34	.49	56.42	.088	1.000	1.000

RC-RD10

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0651	acre-ft
peak discharge	=	1.3364	cfs
area	=	1.6000	acres
time of peak discharge	=	3.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	766665.20	mg/l
peak settleable concentration	=	458.06	ml/l
peak settleable concentration	=	641288.70	mg/l
total sediment yield	=	56.4230	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.00	hrs
period of significant concentration	=	3.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	303.01	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	303.01	ml/l
arithmetic average settleable concentration during period of significant concentration	=	207.35	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	27.65	ml/l

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	70.00	.130	.080	.080	.35	1.0
2	13.90	70.00	.310	.000	.000	.00	1.0

SWS 7
SWS 8

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	1.000	1.0	.0
2	1	.20	400.0	35.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.51	.12	54.51	.053	.716	1.000
2	1.20	.12	182.36	.038	.599	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1748	acre-ft
peak discharge	=	1.6303	cfs
area	=	18.2000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	24.10	ei unit
peak concentration	=	945382.30	mg/l
peak settleable concentration	=	502.02	ml/l
peak settleable concentration	=	702828.10	mg/l
total sediment yield	=	236.8634	tons
representative particle size	=	.0413	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	379.90	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	379.90	ml/l
arithmetic average settleable concentration during period of significant concentration	=	314.91	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	51.17	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	13.53	cfs
time of routed peak discharge	=	3.40	hrs
total drainage area	=	109.10	acres
total runoff volume	=	3.8740	ac-ft
peak runoff discharge	=	14.65	cfs
time to peak discharge	=	3.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1000	hrs
total sediment yield	=	1718.9350	tons
peak sediment concentration	=	765028.30	mg/l
peak settleable concentration	=	421.5168	ml/l
peak settleable concentration	=	590123.60	mg/l
time to peak concentration	=	3.40	hrs
period of significant concentration	=	47.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	148.56	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	177.87	ml/l
arithmetic average settleable concentration during period of significant concentration	=	24.05	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	43.51	ml/l

RC-R011
RC-R012

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	3.874	acre-ft
outflow routed volume	=	1.712	acre-ft
storm volume discharged (plug flow)	=	1.712	acre-ft
pond volume at peak stage	=	2.214	acre-ft
peak stage	=	5.413	ft
peak inflow rate	=	14.647	cfs
peak discharge rate	=	.816	cfs outlet
peak inflow sediment concentration	=	765028.30	mg/l
peak effluent sediment concentration	=	218366.30	mg/l
peak effluent settleable concentration	=	.0002	ml/l
peak effluent settleable concentration	=	.32	mg/l
storm average effluent concentration	=	73847.16	mg/l
average effluent sediment concentration	=	73847.16	mg/l
basin trap efficiency	=	90.61	percent
detention time of flow with sediment	=	13.46	hrs
detention time from hydrograph centers	=	13.46	hrs
detention time including stored flow	=	13.46	hrs
sediment load discharged	=	161.37	tons
period of significant concentration	=	97.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

Rail Cut Pond 25yr 6 hr permit term recl ph1 Jan 2011 X

```
      2       0
   1.62    6.00     .10     .00
      3       2
      2       2       1
   2.75    1.50    1.40
      1      15
13.0000  2.0000   .4250   .2500   .1500   .0750   .0500   .0300   .0200   .0100
  .0080   .0060   .0040   .0020   .0001
 94.30   83.70   78.00   73.30   66.30   45.00   34.00   26.30   20.30   15.00
 13.80   12.30   11.00   10.00     .00
      2       1
  .000    .000    .000    .150    .150    .350
  .000    .000    .000
      1       1
  .150    .150    .400
  .000    .000    .000
      1
  .100    .100    .350
      2       2       1       1       1
42.600  84.000    .500    .000    .100    .350   1.000   1.000    .000
 .2000500.0000   .5000   .9000  1.0000
13.500  84.000    .250    .150    .150    .350   1.000   1.000    .000
 .2000150.0000 20.0000   .9000  1.0000
   .20    1.00   20.00
      3       0       6     500       1       1       2
  .00    1.00    2.00    3.00    4.00    5.50
 .000    .300    .600    .700    .800    .900
  .00     .00     .30     .60     .90    4.00
      1       1       1       1       1
18.300  84.000    .350    .000    .000    .000   1.000   1.000    .000
 .2000100.0000 45.0000  1.0000  1.0000
      1       1       1       1       1
11.200  84.000    .430    .050    .050    .350   1.000   1.000    .000
 .2000 40.0000 35.0000   .9000  1.0000
      1       1       1       1       1
 3.700  84.000    .160    .000    .100    .350   1.000   1.000    .000
 .2000150.0000 33.0000  1.0000  1.0000
      1       1       1       1       1
 1.600  84.000    .070    .000    .020    .400   1.000   1.000    .000
 .2000100.0000 35.0000  1.0000  1.0000
      2       2       1       1       1
 4.300  70.000    .130    .080    .080    .350   1.000   1.000    .000
 .2000300.0000 37.0000  1.0000  1.0000
13.900  70.000    .310    .000    .000    .000   1.000   1.000    .000
 .2000400.0000 35.0000  1.0000  1.0000
   .20    1.00   20.00
      3       0      13     500       1       1       2
  .00    1.00    2.00    3.00    4.00    5.00    5.34    5.40    5.50    5.60
 6.00    7.00    8.00
 .000    .170    .340    .460    .590    .700    .760    .770    .790    .800
 .870   1.040   1.270
  .00     .00     .01     .01     .01     .01     .01     .57    2.49    5.16
20.89   25.00   30.00
```

RAIL CUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

10 Year 6 Hour Storm Hydrologic Model

Phase 2

University of Kentucky computer model
of surface mine hydrology and sedimentology
for more information contact the Agricultural
Engineering Department

the UK model is a design model developed to predict
the hydraulic and sediment response from surface
mined lands for a specified rainfall event (single storm)

version date 9-23-83

disclaimer: neither the University nor any of its employees
accept any responsibility or legal liability for the
conclusions drawn from the results of this model

the following values are now predicted by SEDIMOT II.
they can be found in summary tables.
1. period of significant concentration
2. volume weighted average settleable concentration during period of significant concentration
3. volume weighted average settleable concentration during peak 24 hour period
4. arithmetic average settleable concentration during period of significant concentration
5. arithmetic average settleable concentration during peak 24 hour period

all concentrations are in ml/l.

watershed identification code

Rail Cut Pond 10yr 6 hr permit term recl ph 2 July 2011

input particle size-percent finer distributions

size,mm	13.000	2.000	.425	.250	.150	.075
	.050	.030	.020	.010	.008	.006
	.004	.002	.000			
pct finer no. 1	94.300	83.700	78.000	73.300	66.300	45.000
	34.000	26.300	20.300	15.000	13.800	12.300
	11.000	10.000	.000			

**********input values**********

storm duration	= 6.00	hours
precipation depth	= 1.31	inches
specific gravity	= 2.75	
load rate exponent factor	= 1.50	
submerged bulk specific gravity	= 1.40	

junction 1, branch 1, structure 1

*** hydraulic input values for subwatersheds ***

SWS1
SWS2

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	42.60	69.00	.500	.000	.100	.35	1.0
2	13.50	69.00	.250	.150	.150	.35	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	500.0	.50	.250	1.0	.0
2	1	.20	150.0	20.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

RD3
RD4

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.60	.03	.18	.061	.790	1.000
2	.23	.03	1.88	.072	.881	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.1614	acre-ft
peak discharge	=	.7944	cfs
area	=	56.1000	acres
time of peak discharge	=	3.90	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	13206.87	mg/l
peak settleable concentration	=	7.67	ml/l
peak settleable concentration	=	10742.43	mg/l
total sediment yield	=	2.0532	tons
representative particle size	=	.0713	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	4.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	5.39	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	5.39	ml/l
arithmetic average settleable concentration during period of significant concentration	=	4.28	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.75	ml/l

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	6	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.300	.50	.00	.15
2.00	.600	1.25	.30	.60
3.00	.700	2.06	.60	1.25
4.00	.800	2.90	.90	2.00
5.50	.900	4.17	4.00	3.28

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.150	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	.161	acre-ft
outflow routed volume	=	.148	acre-ft
storm volume discharged (plug flow)	=	.148	acre-ft
pond volume at peak stage	=	.295	acre-ft
peak stage	=	1.321	ft
peak inflow rate	=	.794	cfs
peak discharge rate	=	.096	cfs
peak inflow sediment concentration	=	13206.87	mg/l
peak effluent sediment concentration	=	404.52	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.00	mg/l
storm average effluent concentration	=	392.09	mg/l
average effluent sediment concentration	=	392.09	mg/l
basin trap efficiency	=	96.15	percent
detention time of flow with sediment	=	14.11	hrs
detention time from hydrograph centers	=	14.11	hrs
detention time including stored flow	=	14.11	hrs
sediment load discharged	=	.08	tons
period of significant concentration	=	46.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

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junction 1, branch 1, structure 2

* *

SWS 4

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	18.30	69.00	.350	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	1.000	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.29	.03	33.63	.067	.837	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0526	acre-ft
peak discharge	=	.2873	cfs
area	=	18.3000	acres
time of peak discharge	=	3.70	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	464218.20	mg/l
peak settleable concentration	=	267.28	ml/l
peak settleable concentration	=	374190.00	mg/l
total sediment yield	=	33.6305	tons
representative particle size	=	.0668	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	3.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	229.16	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	229.16	ml/l
arithmetic average settleable concentration during period of significant concentration	=	203.08	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	32.15	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	.10	cfs
time of routed peak discharge	=	7.00	hrs
total drainage area	=	74.40	acres
total runoff volume	=	.2140	ac-ft
peak runoff discharge	=	.29	cfs
time to peak discharge	=	3.80	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	33.7094	tons
peak sediment concentration	=	455309.40	mg/l
peak settleable concentration	=	261.5257	ml/l
peak settleable concentration	=	366136.00	mg/l
time to peak concentration	=	3.80	hrs
period of significant concentration	=	46.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	61.67	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	74.36	ml/l
arithmetic average settleable concentration during period of significant concentration	=	13.58	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	26.16	ml/l

RD-7

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

* *
junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	11.20	69.00	.430	.050	.050	.35	1.0

SUBS-3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.17	.03	1.70	.063	.809	1.000

RD-5+6

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0322	acre-ft
peak discharge	=	.1655	cfs
area	=	11.2000	acres
time of peak discharge	=	3.70	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	44631.35	mg/l
peak settleable concentration	=	25.50	ml/l
peak settleable concentration	=	35693.44	mg/l
total sediment yield	=	1.7037	tons
representative particle size	=	.0634	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	3.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	21.82	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	21.82	ml/l
arithmetic average settleable concentration during period of significant concentration	=	19.03	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	3.09	ml/l

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null structure
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* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.70	69.00	.160	.000	.100	.35	1.0

SUBS5

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.07	.03	1.11	.078	.922	1.000

RD-9

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0106	acre-ft
peak discharge	=	.0665	cfs
area	=	3.7000	acres
time of peak discharge	=	3.70	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	90970.87	mg/l
peak settleable concentration	=	53.47	ml/l
peak settleable concentration	=	74863.77	mg/l
total sediment yield	=	1.1146	tons
representative particle size	=	.0777	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	3.30	hrs
volume weighted average settleable concentration during period of significant concentration	=	43.22	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	43.22	ml/l
arithmetic average settleable concentration during period of significant concentration	=	41.22	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	5.67	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	.44	cfs
time of routed peak discharge	=	4.00	hrs
total drainage area	=	89.30	acres
total runoff volume	=	.2569	ac-ft
peak runoff discharge	=	.49	cfs
time to peak discharge	=	4.00	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	36.5141	tons
peak sediment concentration	=	293720.10	mg/l
peak settleable concentration	=	168.7713	ml/l
peak settleable concentration	=	236279.80	mg/l
time to peak concentration	=	4.00	hrs
period of significant concentration	=	46.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	57.76	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	67.31	ml/l
arithmetic average settleable concentration during period of significant concentration	=	9.61	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	18.45	ml/l

RD-8

* * * * * * * * * * * * *
null structure
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junction 2, branch 2, structure 1
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*** hydraulic input values for subwatersheds ***

SWS 6

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.60	69.00	.070	.000	.020	.40	.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.03	.03	.40	.088	1.000	1.000

RD-10

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0046	acre-ft
peak discharge	=	.0333	cfs
area	=	1.6000	acres
time of peak discharge	=	3.50	hrs
beta	=	1.0000	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	87163.77	mg/l
peak settleable concentration	=	52.08	ml/l
peak settleable concentration	=	72909.45	mg/l
total sediment yield	=	.4050	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.50	hrs
period of significant concentration	=	2.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	39.74	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	39.74	ml/l
arithmetic average settleable concentration during period of significant concentration	=	39.88	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	4.65	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	69.00	.130	.080	.080	.35	1.0
2	13.90	69.00	.310	.000	.000	.00	1.0

SW57
SW58

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	.250	1.0	.0
2	1	.20	400.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.08	.03	2.46	.078	.922	1.000
2	.23	.03	9.11	.069	.853	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0524	acre-ft
peak discharge	=	.3011	cfs
area	=	18.2000	acres
time of peak discharge	=	3.70	hrs
beta	=	.0100	
rainfall erositivity factor	=	15.26	ei unit
peak concentration	=	182314.80	mg/l
peak settleable concentration	=	105.77	ml/l
peak settleable concentration	=	148083.70	mg/l
total sediment yield	=	11.5675	tons
representative particle size	=	.0705	mm
time of peak concentration	=	3.70	hrs
period of significant concentration	=	3.70	hrs
volume weighted average settleable concentration during period of significant concentration	=	88.14	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	88.14	ml/l
arithmetic average settleable concentration during period of significant concentration	=	78.70	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	12.13	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	.51	cfs
time of routed peak discharge	=	4.20	hrs
total drainage area	=	109.10	acres
total runoff volume	=	.3138	ac-ft
peak runoff discharge	=	.76	cfs
time to peak discharge	=	4.20	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1000	hrs
total sediment yield	=	48.4769	tons
peak sediment concentration	=	241666.00	mg/l
peak settleable concentration	=	139.2201	ml/l
peak settleable concentration	=	194908.10	mg/l
time to peak concentration	=	4.20	hrs
period of significant concentration	=	46.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	63.13	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	71.40	ml/l
arithmetic average settleable concentration during period of significant concentration	=	8.72	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	16.73	ml/l

RD-11
RD-12

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	.314	acre-ft
outflow routed volume	=	.077	acre-ft
storm volume discharged (plug flow)	=	.077	acre-ft
pond volume at peak stage	=	.352	acre-ft
peak stage	=	2.029	ft
peak inflow rate	=	.764	cfs
peak discharge rate	=	.010	cfs outlet
peak inflow sediment concentration	=	241666.00	mg/l
peak effluent sediment concentration	=	13619.42	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.02	mg/l
storm average effluent concentration	=	9748.23	mg/l
average effluent sediment concentration	=	9748.23	mg/l
basin trap efficiency	=	97.99	percent
detention time of flow with sediment	=	41.28	hrs
detention time from hydrograph centers	=	41.28	hrs
detention time including stored flow	=	41.28	hrs
sediment load discharged	=	.97	tons
period of significant concentration	=	96.60	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

*** run completed ****

RC10-6p2

Rail Cut Pond 10yr 6 hr permit term recl ph 2 Jan 2011 X

```
     2        0
  1.31     6.00      .10      .00
     3        2
     2        2         1
  2.75     1.50     1.40
     1       15
 13.0000  2.0000   .4250    .2500    .1500    .0750    .0500    .0300    .0200    .0100
  .0080    .0060   .0040    .0020    .0001
 94.30    83.70    78.00    73.30    66.30    45.00    34.00    26.30    20.30    15.00
 13.80    12.30    11.00    10.00      .00
     2        1
  .000     .000     .000     .150     .150     .350
  .000     .000     .000
     1        1
  .150     .150     .400
  .000     .000     .000
     1
  .100     .100     .350
     2        2        1        1        1
 42.600   69.000    .500     .000     .100     .350    1.000    1.000    .000
  .2000500.0000   .5000    .2500  1.0000
 13.500   69.000    .250     .150     .150     .350    1.000    1.000    .000
  .2000150.0000 20.0000    .2500  1.0000
   .20     1.00    20.00
     3        0        6      500        1        1        2
  .00     1.00     2.00     3.00     4.00     5.50
  .000     .300     .600     .700     .800     .900
  .00      .00      .30      .60      .90     4.00
     1        1        1        1        1
 18.300   69.000    .350     .000     .000     .000    1.000    1.000    .000
  .2000100.0000  45.0000  1.0000  1.0000
     1        1        1        1        1
 11.200   69.000    .430     .050     .050     .350    1.000    1.000    .000
  .2000 40.0000  35.0000    .2500  1.0000
     1        1        1        1        1
  3.700   69.000    .160     .000     .100     .350    1.000    1.000    .000
  .2000150.0000  33.0000    .2500  1.0000
     1        1        1        1        1
  1.600   69.000    .070     .000     .020     .400    1.000    1.000    .000
  .2000100.0000  35.0000    .2500  1.0000
     2        2        1        1        1
  4.300   69.000    .130     .080     .080     .350    1.000    1.000    .000
  .2000300.0000  37.0000    .2500  1.0000
 13.900   69.000    .310     .000     .000     .000    1.000    1.000    .000
  .2000400.0000  35.0000    .2500  1.0000
   .20     1.00    20.00
     3        0       13      500        1        1        2
  .00     1.00     2.00     3.00     4.00     5.00     5.34     5.40     5.50     5.60
 6.00     7.00     8.00
  .000     .170     .340     .460     .590     .700     .760     .770     .790     .800
  .870    1.040    1.270
  .00      .00      .01      .01      .01      .01      .01      .57     2.49     5.16
20.89    25.00    30.00
```

RAIL CUT SEDIMENT POND
PERMIT TERM RECLAMATION PLAN

100 Year 6 Hour Storm Hydrologic Model

Phase 2

```
*****************************************************************
*****************************************************************

       University of Kentucky computer model
       of surface mine hydrology and sedimentology
       for more information contact the Agricultural
       Engineering Department

       the UK model is a design model developed to predict
       the hydraulic and sediment response from surface
       mined lands for a specified rainfall event (single storm)

       version date 9-23-83

       disclaimer: neither the University nor any of its employees
       accept any responsibility or legal liability for the
       conclusions drawn from the results of this model

*****************************************************************
*****************************************************************



*****************************************************************
*                                                               *
*     the following values are now predicted by SEDIMOT II.     *
*     they can be found in summary tables.                      *
*      1. period of significant concentration                   *
*      2. volume weighted average settleable concentration      *
*         during period of significant concentration            *
*      3. volume weighted average settleable concentration      *
*         during peak 24 hour period                            *
*      4. arithmetic average settleable concentration during    *
*         period of significant concentration                   *
*      5. arithmetic average settleable concentration           *
*         during peak 24 hour period                            *
*                                                               *
*     all concentrations are in ml/l.                           *
*                                                               *
*****************************************************************



            *********************************************

                watershed identification code
                -----------------------------
             Rail Cut Pond  100yr 6 hr  permit term recl phase 2  July 2011

            *********************************************


            input particle size-percent finer distributions
            -----------------------------------------------


size,mm           13.000  2.000   .425   .250   .150   .075
                    .050   .030   .020   .010   .008   .006
                    .004   .002   .000
pct finer no. 1   94.300 83.700 78.000 73.300 66.300 45.000
                  34.000 26.300 20.300 15.000 13.800 12.300
                  11.000 10.000   .000


  ********************input values**********************

  storm duration                      =       6.00   hours
  precipation depth                   =       2.05   inches
  specific gravity                    =       2.75
  load rate exponent factor           =       1.50
  submerged bulk specific gravity     =       1.40
```



```
          * * * * * * * * * * * * * * * * * * * * * * * *
             junction  1, branch  1, structure  1
          * * * * * * * * * * * * * * * * * * * * * * * *


          *** hydraulic input values for subwatersheds ***

water    area     curve      tc      tt    routing coefficients    unit
shed     acres    number     hr      hr       k-hrs        x       hydro
-------------------------------------------------------------------------
  1      42.60    69.00     .500    .000      .100       .35      1.0
  2      13.50    69.00     .250    .150      .150       .35      1.0

          *** sediment input values for subwatersheds ***

water    seg      soil       length      slope      cp        part      surf
shed     num        k          feet        pct      value     opt       cond
-------------------------------------------------------------------------------
  1       1       .20        500.0        .50      .250      1.0        .0
  2       1       .20        150.0      20.00      .250      1.0        .0

          * * * computed values for individual watersheds * * *

watershed   peak flow     runoff     sediment    diam    delivery    delivery
              (cfs)      (inches)      tons      (mm)    ratio 1     ratio 2
-------------------------------------------------------------------------------
    1          7.27         .23         2.08     .035      .573       1.000
    2          3.29         .23        24.25     .052      .699        .966

 note:  sediment does not include possible deposition by delivery ratio 2


          ***** summary table for total watershed *****
          ---------------------------------------------

  runoff volume                                =      1.0982   acre-ft
  peak discharge                               =      9.2363   cfs
  area                                         =     56.1000   acres
  time of peak discharge                       =        3.40   hrs
  beta                                         =      1.0000
  rainfall erositivity factor                  =       40.00   ei unit
  peak concentration                           =    37130.50   mg/l
  peak settleable concentration                =       20.14   ml/l
  peak settleable concentration                =    28191.51   mg/l
  total sediment yield                         =      25.5108   tons
  representative particle size                 =       .0478   mm
  time of peak concentration                   =        3.20   hrs
  period of significant concentration=         =        4.50   hrs
  volume weighted average settleable
    concentration during period of
    significant concentration                  =        9.14   ml/l
  volume weighted average settleable
    concentration during peak 24 hour
    period                                     =        9.14   ml/l
  arithmetic average settleable
    concentration during period of
    significant concentration                  =        6.00   ml/l
  arithmetic average settleable
    concentration during peak 24 hour
    period                                     =        1.12   ml/l
```

* *

pond results

* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	6	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.300	.50	.00	.15
2.00	.600	1.25	.30	.60
3.00	.700	2.06	.60	1.25
4.00	.800	2.90	.90	2.00
5.50	.900	4.17	4.00	3.28

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.150	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	1.098	acre-ft
outflow routed volume	=	.999	acre-ft
storm volume discharged (plug flow)	=	.999	acre-ft
pond volume at peak stage	=	1.128	acre-ft
peak stage	=	2.813	ft
peak inflow rate	=	9.236	cfs
peak discharge rate	=	.544	cfs
peak inflow sediment concentration	=	37130.50	mg/l
peak effluent sediment concentration	=	5556.92	mg/l
peak effluent settleable concentration	=	.0000	ml/l
peak effluent settleable concentration	=	.01	mg/l
storm average effluent concentration	=	2179.57	mg/l
average effluent sediment concentration	=	2179.57	mg/l
basin trap efficiency	=	88.36	percent
detention time of flow with sediment	=	15.20	hrs
detention time from hydrograph centers	=	15.20	hrs
detention time including stored flow	=	15.20	hrs
sediment load discharged	=	2.97	tons
period of significant concentration	=	46.80	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

1

SW54

* *
junction 1, branch 1, structure 2
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	18.30	69.00	.350	.000	.000	.00	1.0

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	45.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	3.77	.23	103.97	.043	.636	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.3582	acre-ft
peak discharge	=	3.7660	cfs
area	=	18.3000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erosivity factor	=	40.00	ei unit
peak concentration	=	285891.60	mg/l
peak settleable concentration	=	152.90	ml/l
peak settleable concentration	=	214059.50	mg/l
total sediment yield	=	103.9678	tons
representative particle size	=	.0433	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	4.10	hrs
volume weighted average settleable concentration during period of significant concentration	=	104.46	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	104.46	ml/l
arithmetic average settleable concentration during period of significant concentration	=	77.25	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	13.20	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	.54	cfs
time of routed peak discharge	=	6.80	hrs
total drainage area	=	74.40	acres
total runoff volume	=	1.4564	ac-ft
peak runoff discharge	=	3.77	cfs
time to peak discharge	=	3.20	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	106.9369	tons
peak sediment concentration	=	285493.00	mg/l
peak settleable concentration	=	148.3551	ml/l
peak settleable concentration	=	207697.20	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	27.93	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	34.28	ml/l
arithmetic average settleable concentration during period of significant concentration	=	5.97	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	10.81	ml/l

RD 7

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 1, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	11.20	69.00	.430	.050	.050	.35	1.0

SWS3

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	40.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	2.07	.23	20.55	.038	.600	.990

RD5+6

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.2192	acre-ft
peak discharge	=	2.0736	cfs
area	=	11.2000	acres
time of peak discharge	=	3.30	hrs
beta	=	1.0000	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	95928.14	mg/l
peak settleable concentration	=	50.16	ml/l
peak settleable concentration	=	70227.67	mg/l
total sediment yield	=	20.3465	tons
representative particle size	=	.0376	mm
time of peak concentration	=	3.30	hrs
period of significant concentration	=	4.20	hrs
volume weighted average settleable concentration during period of significant concentration	=	34.57	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	34.57	ml/l
arithmetic average settleable concentration during period of significant concentration	=	25.65	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	4.49	ml/l

* * * * * * * * * * * *
null structure
* * * * * * * * * * * *

1

* *
junction 2, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	3.70	69.00	.160	.000	.100	.35	1.0

SWS5

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	150.0	33.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.08	.23	15.21	.059	.773	1.000

RD9

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0724	acre-ft
peak discharge	=	.9784	cfs
area	=	3.7000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	225244.20	mg/l
peak settleable concentration	=	127.22	ml/l
peak settleable concentration	=	178109.50	mg/l
total sediment yield	=	15.2051	tons
representative particle size	=	.0593	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.50	hrs
volume weighted average settleable concentration during period of significant concentration	=	80.61	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	80.61	ml/l
arithmetic average settleable concentration during period of significant concentration	=	63.73	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	9.29	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.40	
previous muskingum routing k	=	.1500	hrs
previous routed peak discharge	=	4.64	cfs
time of routed peak discharge	=	3.40	hrs
total drainage area	=	89.30	acres
total runoff volume	=	1.7481	ac-ft
peak runoff discharge	=	5.20	cfs
time to peak discharge	=	3.40	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1500	hrs
total sediment yield	=	142.4502	tons
peak sediment concentration	=	221432.60	mg/l
peak settleable concentration	=	116.2145	ml/l
peak settleable concentration	=	162700.30	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	31.44	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	37.15	ml/l
arithmetic average settleable concentration during period of significant concentration	=	5.54	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	9.96	ml/l

RD8

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 2, branch 2, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	1.60	69.00	.070	.000	.020	.40	.0

SUB6

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	100.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	.67	.23	6.38	.088	1.000	1.000

RD10

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.0313	acre-ft
peak discharge	=	.6734	cfs
area	=	1.6000	acres
time of peak discharge	=	3.00	hrs
beta	=	1.0000	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	256014.10	mg/l
peak settleable concentration	=	152.96	ml/l
peak settleable concentration	=	214146.90	mg/l
total sediment yield	=	6.3784	tons
representative particle size	=	.0883	mm
time of peak concentration	=	3.00	hrs
period of significant concentration	=	3.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	86.14	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	86.14	ml/l
arithmetic average settleable concentration during period of significant concentration	=	65.19	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	8.15	ml/l

* * * * * * * * * * * * *
null structure
* * * * * * * * * * * * *

1

* *
junction 3, branch 1, structure 1
* *

*** hydraulic input values for subwatersheds ***

water shed	area acres	curve number	tc hr	tt hr	routing coefficients k-hrs	x	unit hydro
1	4.30	69.00	.130	.080	.080	.35	1.0
2	13.90	69.00	.310	.000	.000	.00	1.0

SWS7
SWS8

*** sediment input values for subwatersheds ***

water shed	seg num	soil k	length feet	slope pct	cp value	part opt	surf cond
1	1	.20	300.0	37.00	.250	1.0	.0
2	1	.20	400.0	35.00	.250	1.0	.0

* * * computed values for individual watersheds * * *

watershed	peak flow (cfs)	runoff (inches)	sediment tons	diam (mm)	delivery ratio 1	delivery ratio 2
1	1.25	.23	33.59	.059	.773	1.000
2	3.03	.23	114.24	.046	.658	1.000

note: sediment does not include possible deposition by delivery ratio 2

***** summary table for total watershed *****

runoff volume	=	.3563	acre-ft
peak discharge	=	4.1352	cfs
area	=	18.2000	acres
time of peak discharge	=	3.20	hrs
beta	=	.0100	
rainfall erositivity factor	=	40.00	ei unit
peak concentration	=	400065.20	mg/l
peak settleable concentration	=	218.35	ml/l
peak settleable concentration	=	305685.00	mg/l
total sediment yield	=	147.8253	tons
representative particle size	=	.0501	mm
time of peak concentration	=	3.20	hrs
period of significant concentration	=	3.90	hrs
volume weighted average settleable concentration during period of significant concentration	=	147.28	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	147.28	ml/l
arithmetic average settleable concentration during period of significant concentration	=	112.07	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	18.21	ml/l

summary table of combined hydrograph and sedigraph values

previous muskingum routing x	=	.35	
previous muskingum routing k	=	.1000	hrs
previous routed peak discharge	=	5.09	cfs
time of routed peak discharge	=	3.60	hrs
total drainage area	=	109.10	acres
total runoff volume	=	2.1357	ac-ft
peak runoff discharge	=	7.38	cfs
time to peak discharge	=	3.60	hrs
previous structure delivery ratio	=	1.00	
previous structure travel time	=	.1000	hrs
total sediment yield	=	296.6228	tons
peak sediment concentration	=	330005.80	mg/l
peak settleable concentration	=	177.1405	ml/l
peak settleable concentration	=	247996.80	mg/l
time to peak concentration	=	3.20	hrs
period of significant concentration	=	47.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	53.16	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	60.85	ml/l
arithmetic average settleable concentration during period of significant concentration	=	7.39	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	13.57	ml/l

2011
2012

* *
pond results
* *

***** control variables options *****

flow	fractn	isdo	nrhp	nsp	ncstr
3	0	1	500	13	2

***** basin geometry *****

stage (ft)	area (acres)	average depth (ft)	discharge (cfs)	capacity (acres-ft)
.00	.000	.00	.00	.00
1.00	.170	.50	.00	.09
2.00	.340	1.25	.01	.34
3.00	.460	1.99	.01	.74
4.00	.590	2.73	.01	1.26
5.00	.700	3.45	.01	1.91
5.34	.760	3.70	.01	2.16
5.40	.770	3.74	.57	2.20
5.50	.790	3.81	2.49	2.28
5.60	.800	3.87	5.16	2.36
6.00	.870	4.14	20.89	2.70
7.00	1.040	4.79	25.00	3.65
8.00	1.270	5.38	30.00	4.81

***** storm event summary *****

turbulence factor	=	1.00	
permanent pool capacity	=	.085	acre-ft
dead storage	=	20.00	percent
time increment outflow	=	.20	hrs
viscosity	=	.009	cm**2/sec
inflow runoff volume	=	2.136	acre-ft
outflow routed volume	=	.083	acre-ft
storm volume discharged (plug flow)	=	.083	acre-ft
pond volume at peak stage	=	2.097	acre-ft
peak stage	=	5.257	ft
peak inflow rate	=	7.380	cfs
peak discharge rate	=	.010	cfs
peak inflow sediment concentration	=	330005.80	mg/l
peak effluent sediment concentration	=	68756.41	mg/l
peak effluent settleable concentration	=	.0001	ml/l
peak effluent settleable concentration	=	.10	mg/l
storm average effluent concentration	=	22932.24	mg/l
average effluent sediment concentration	=	22932.24	mg/l
basin trap efficiency	=	99.16	percent
detention time of flow with sediment	=	39.67	hrs
detention time from hydrograph centers	=	39.67	hrs
detention time including stored flow	=	39.67	hrs
sediment load discharged	=	2.48	tons
period of significant concentration	=	97.00	hrs
volume weighted average settleable concentration during period of significant concentration	=	.00	ml/l
volume weighted average settleable concentration during peak 24 hour period	=	.00	ml/l
arithmetic average settleable concentration during period of significant concentration	=	.00	ml/l
arithmetic average settleable concentration during peak 24 hour period	=	.00	ml/l

outlet

*** run completed ****

RC1006p2

Rail Cut Pond 100yr 6 hr permit term recl phase 2 Jan 2011 X

```
     2        0
  2.05     6.00      .10      .00
     3        2
     2        2         1
  2.75     1.50     1.40
     1       15
13.0000  2.0000   .4250   .2500   .1500   .0750   .0500   .0300   .0200   .0100
 .0080    .0060   .0040   .0020   .0001
 94.30    83.70   78.00   73.30   66.30   45.00   34.00   26.30   20.30   15.00
 13.80    12.30   11.00   10.00     .00
     2        1
  .000     .000    .000    .150    .150    .350
  .000     .000    .000
     1        1
  .150     .150    .400
  .000     .000    .000
     1
  .100     .100    .350
     2        2       1       1       1
42.600   69.000    .500    .000    .100    .350   1.000   1.000    .000
 .2000500.0000   .5000   .2500  1.0000
13.500   69.000    .250    .150    .150    .350   1.000   1.000    .000
 .2000150.0000 20.0000   .2500  1.0000
  .20     1.00   20.00
     3        0       6     500       1       1       2
  .00     1.00    2.00    3.00    4.00    5.50
 .000     .300    .600    .700    .800    .900
  .00      .00     .30     .60     .90    4.00
     1        1       1       1       1
18.300   69.000    .350    .000    .000    .000   1.000   1.000    .000
 .2000100.0000  45.0000   .2500  1.0000
     1        1       1       1       1
11.200   69.000    .430    .050    .050    .350   1.000   1.000    .000
 .2000 40.0000  35.0000   .2500  1.0000
     1        1       1       1       1
 3.700   69.000    .160    .000    .100    .350   1.000   1.000    .000
 .2000150.0000  33.0000   .2500  1.0000
     1        1       1       1       1
 1.600   69.000    .070    .000    .020    .400   1.000   1.000    .000
 .2000100.0000  35.0000   .2500  1.0000
     2        2       1       1       1
 4.300   69.000    .130    .080    .080    .350   1.000   1.000    .000
 .2000300.0000  37.0000   .2500  1.0000
13.900   69.000    .310    .000    .000    .000   1.000   1.000    .000
 .2000400.0000  35.0000   .2500  1.0000
  .20     1.00   20.00
     3        0      13     500       1       1       2
  .00     1.00    2.00    3.00    4.00    5.00    5.34    5.40    5.50    5.60
 6.00     7.00    8.00
 .000     .170    .340    .460    .590    .700    .760    .770    .790    .800
 .870    1.040   1.270
  .00      .00     .01     .01     .01     .01     .01     .57    2.49    5.16
20.89    25.00   30.00
```

TWIN PEAKS ENGINEERING HAS COMPILED AND RELIED ON DATA AND MAPS FROM EXISTING, APPROVED APPLICATIONS FOR THE SUNNYSIDE COAL MINE. THESE MAPS HAVE BEEN RECREATED AND RENUMBERED TO REFLECT THE PERMIT AREA FOR THE SUNNYSIDE COGENERATION PROJECT.

SUNNYSIDE COGENERATION ASSOCIATES PERMIT BOUNDARY

SUNNYSIDE CORPORATE BOUNDARY

EAST CARBON CITY CORPORATE BOUNDARY

EAST CARBON CITY CORPORATE BOUNDARY

LEGEND

1 – HIGH SENSITIVITY
2 – MEDIUM SENSITIVTY
3 – LOW SENSITIVITY

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

PLOTTED DATE: Wednesday, 09 February 2011 - 10:30am

REGISTERED PROFESSIONAL ENGINEER
5152251
B. SCOTT CARLSON
STATE OF UTAH

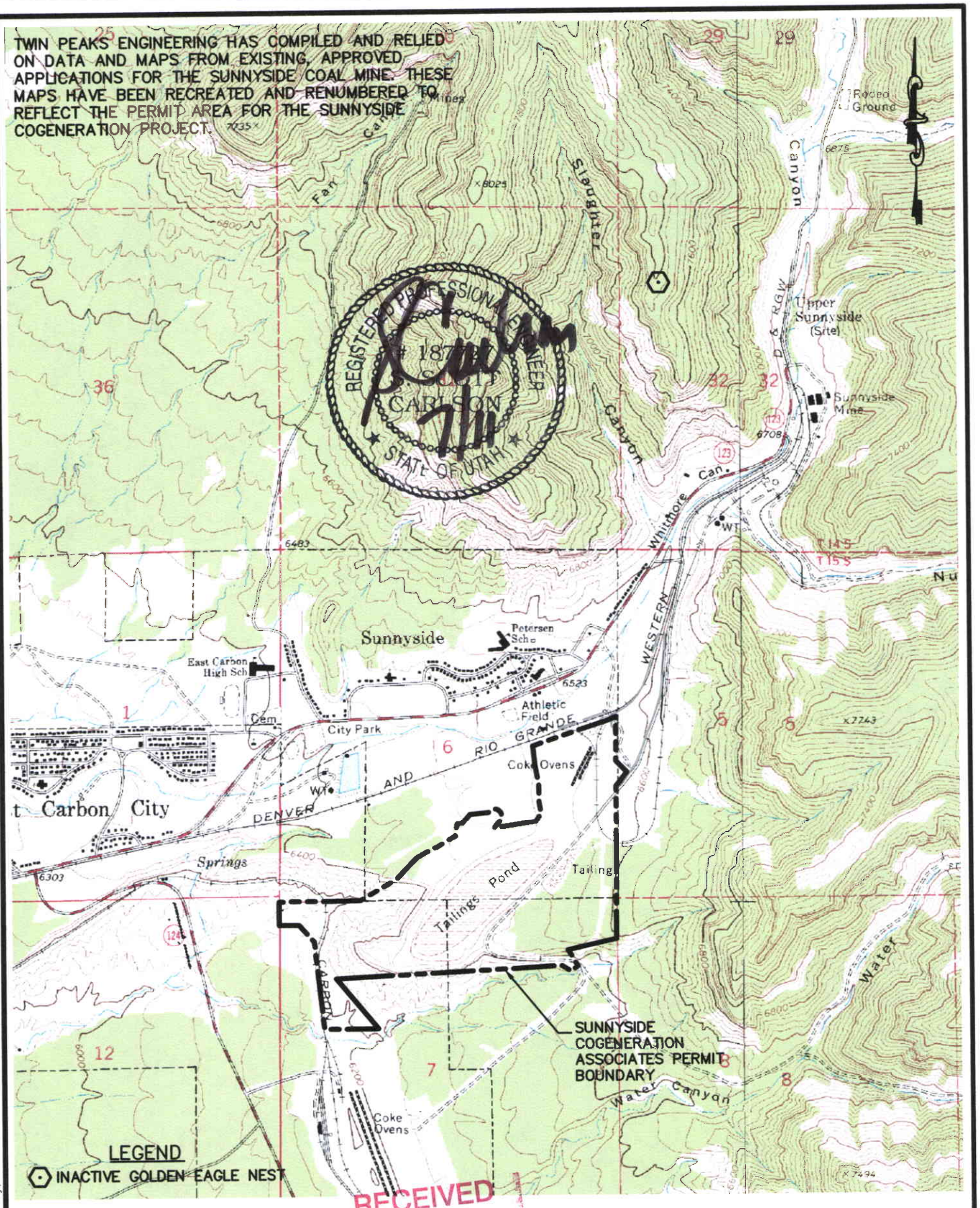
DATE: 9-28-95
SCALE: NOT TO SCALE
PROJECT NO.: -

Sunnyside Cogeneration Associates
SENSITIVITY RANKINGS

TWIN PEAKS
Engineering & Land Surveying
2284 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

AH | AH | SSC

4-3



RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

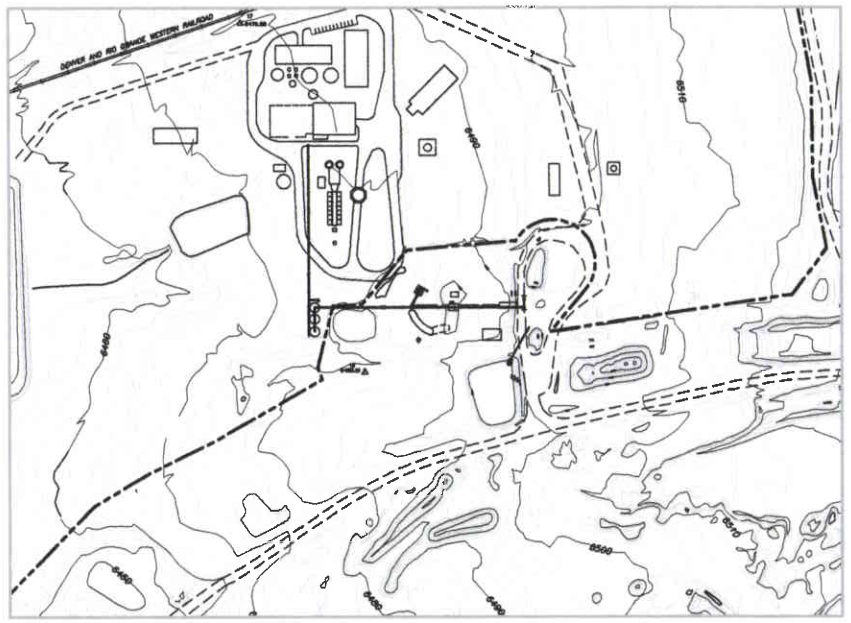
PLOTTED DATE: Monday, 06 December 2010 - 4:31pm

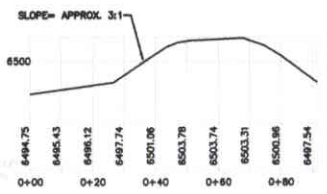
TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

SUNNYSIDE COGENERATION ASSOCIATES
WILDLIFE
SUNNYSIDE, CARBON COUNTY, UTAH

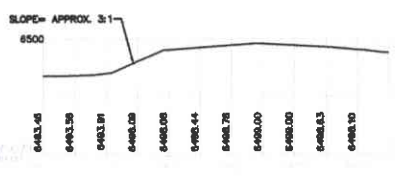
SCALE: 1" =2000'

SHEET NO. 3-2

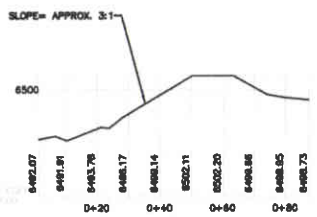




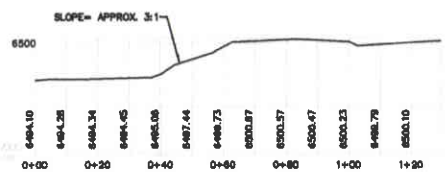
SECTION B



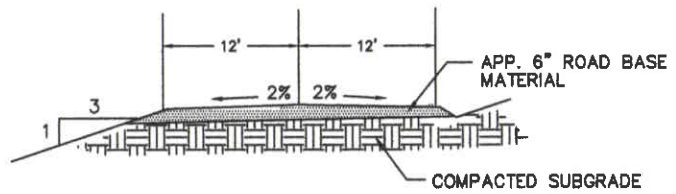
SECTION D



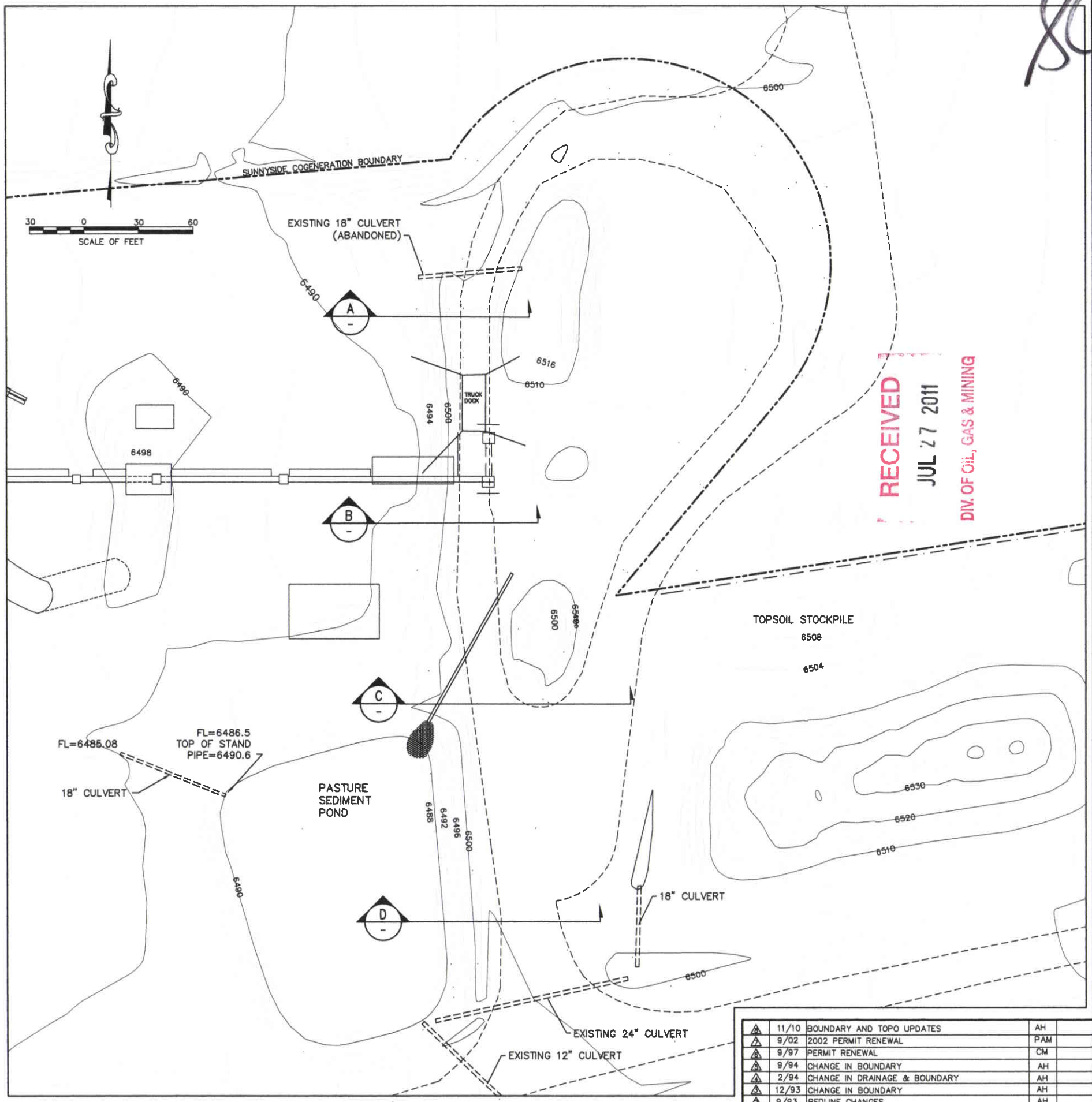
SECTION A



SECTION C



TYPICAL ROAD CROSS SECTION
NTS



RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

REV	DATE	DESCRIPTION	BY	APP'D
6	11/10	BOUNDARY AND TOPO UPDATES	AH	
5	9/02	2002 PERMIT RENEWAL	PAM	
4	9/97	PERMIT RENEWAL	CM	
3	9/94	CHANGE IN BOUNDARY	AH	
2	2/94	CHANGE IN DRAINAGE & BOUNDARY	AH	
1	12/93	CHANGE IN BOUNDARY	AH	
0	9/93	REDLINE CHANGES	AH	

9-28-94
SCALE 1" = 30'
PROJECT NO. -

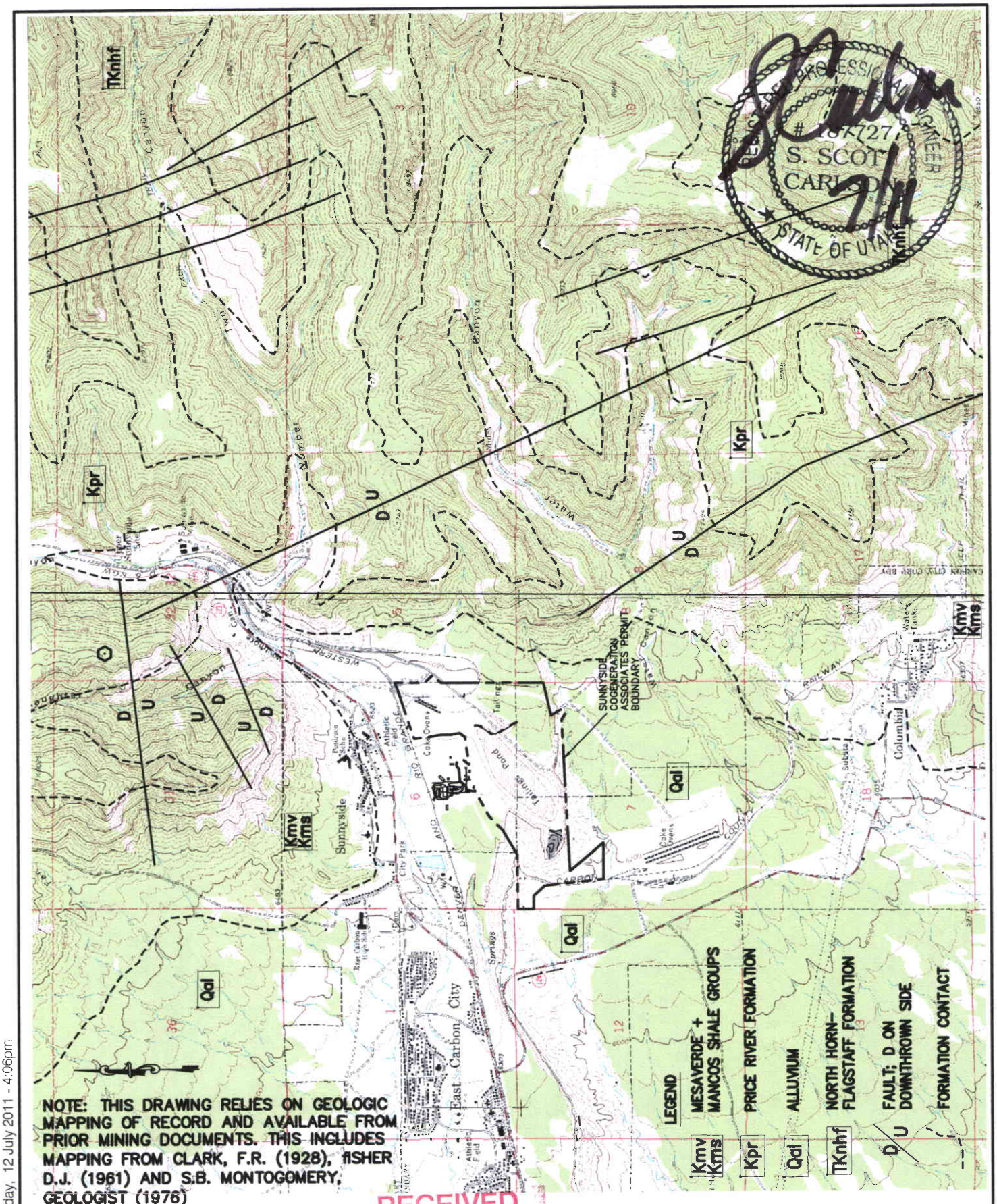
Sunnyside Cogeneration Associates
ACCESS ROAD DRAWING

TWIN PEAKS
Engineering & Land Surveying
2284 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AH
DRAWN AH
CHECKED SSC

SHEET 5-3

PLOTTED DATE: Friday, 04 February 2011 - 6:47pm



NOTE: THIS DRAWING RELIES ON GEOLOGIC MAPPING OF RECORD AND AVAILABLE FROM PRIOR MINING DOCUMENTS. THIS INCLUDES MAPPING FROM CLARK, F.R. (1928), FISHER D.J. (1961) AND S.B. MONTGOMERY, GEOLOGIST (1976)

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

SUNNYSIDE COGENERATION ASSOCIATES
HYDROGEOLOGIC MAP
SUNNYSIDE, CARBON COUNTY, UTAH

SCALE: 1" =3000'

SHEET NO.
6-2

PLOTTED DATE: Tuesday, 12 July 2011 - 4:06pm

REVEGETATED AREA

36"CMP

NATURAL DRAINAGE

Two 6"Pipes

36"CMP

CW-SWS4
3 ACRES

NATURAL DRAINAGE

RECLAIMED AREA

36"CMP

CW-SWS1
27.7 ACRES

UNDISTURBED AREA

CW-SWS7
7.4 ACRES

UNDISTURBED AREA

CW-SWS2
14 ACRES

NATURAL DRAINAGE

RECLAIMED AREA

BOR-SWS1
227 ACRES

NATURAL DRAINAGE

UNDISTURBED AREA

BOR-SWS1
227 ACRES

NATURAL DRAINAGE

CONT. ON PLATE 7

SCA PERMIT BOUNDARY

6600
6640
6800
7000
7200
7400
7600
7760
X 7743

6650
6675
6700
6725
6750
6775
6780
6785
6790
6795
6800
6825

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

LEGEND

- PERMIT BOUNDARY
- COLLECTOR DITCH
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- ROAD
- ALTERNATE SEDIMENT CONTROLS
- UPDES POINTS
- BORROW AREA POND DRAINAGE
- PASTURE SEDIMENT POND DRAINAGE

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

REV	DATE	DESCRIPTION	BY	APP'D
5				
4				
3	11/10	TOPO UPDATES	AH	
2	9/02	2002 PERMIT RENEWAL	AH	
1	9/97	PERMIT RENEWAL-UPDATES	AH	
0	11/93	UPDATE TOPO AND DRAWING	SSC	

REGISTERED PROFESSIONAL ENGINEER
181627
S. SCOTT CARLSON
STATE OF UTAH

DATE 6-27-11
SCALE
PROJECT NO. -

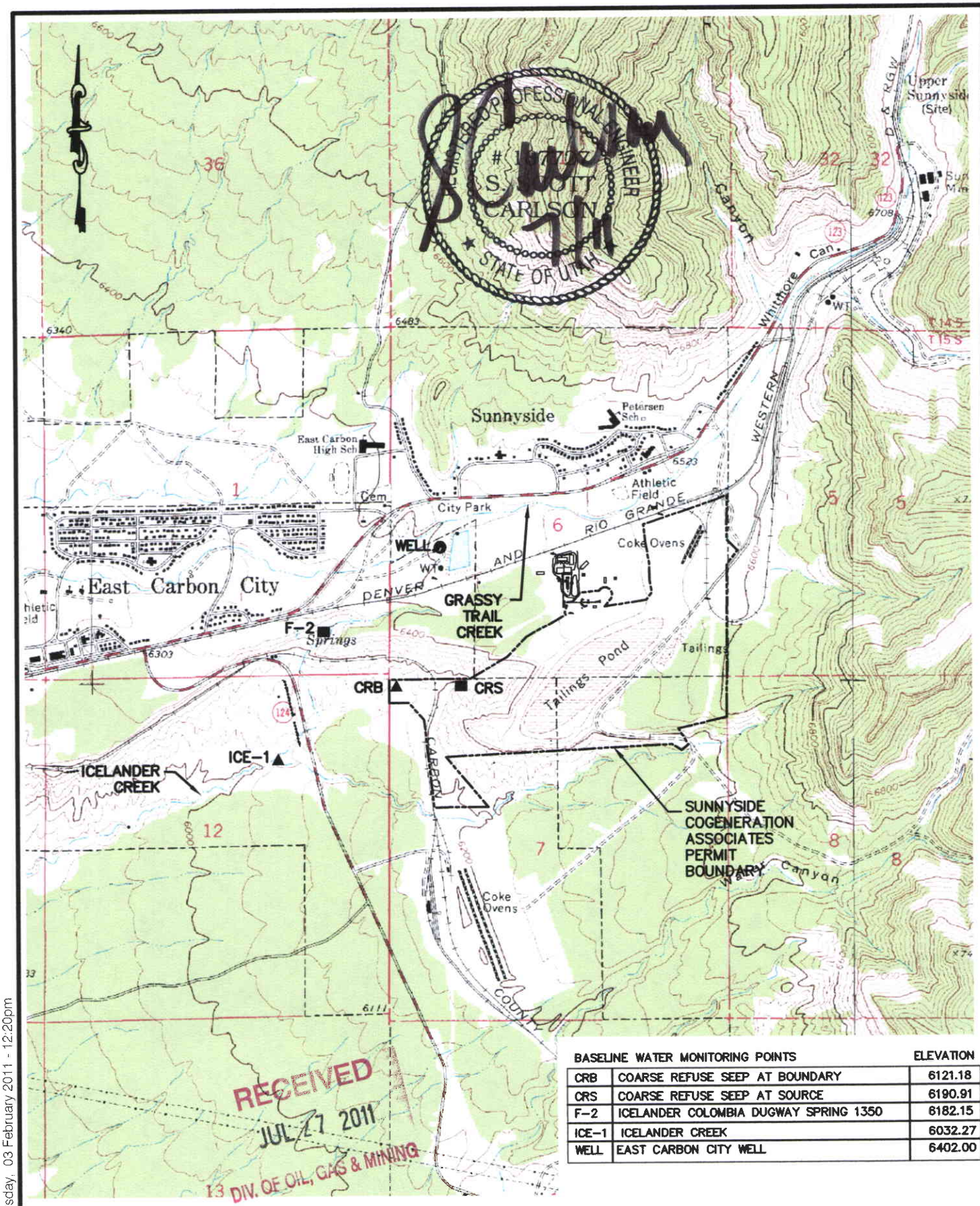
Sunnyside Cogeneration Associates
HYDROLOGIC INDEX MAP
BORROW & PASTURE POND (UPPER DRAINAGE)

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AH
DRAWN AH
CHECKED SSC
SHEET

7-1F

PLOTTED DATE: Monday, 07 February 2011 - 7:19pm



BASELINE WATER MONITORING POINTS		ELEVATION
CRB	COARSE REFUSE SEEP AT BOUNDARY	6121.18
CRS	COARSE REFUSE SEEP AT SOURCE	6190.91
F-2	ICELANDER COLOMBIA DUGWAY SPRING 1350	6182.15
ICE-1	ICELANDER CREEK	6032.27
WELL	EAST CARBON CITY WELL	6402.00

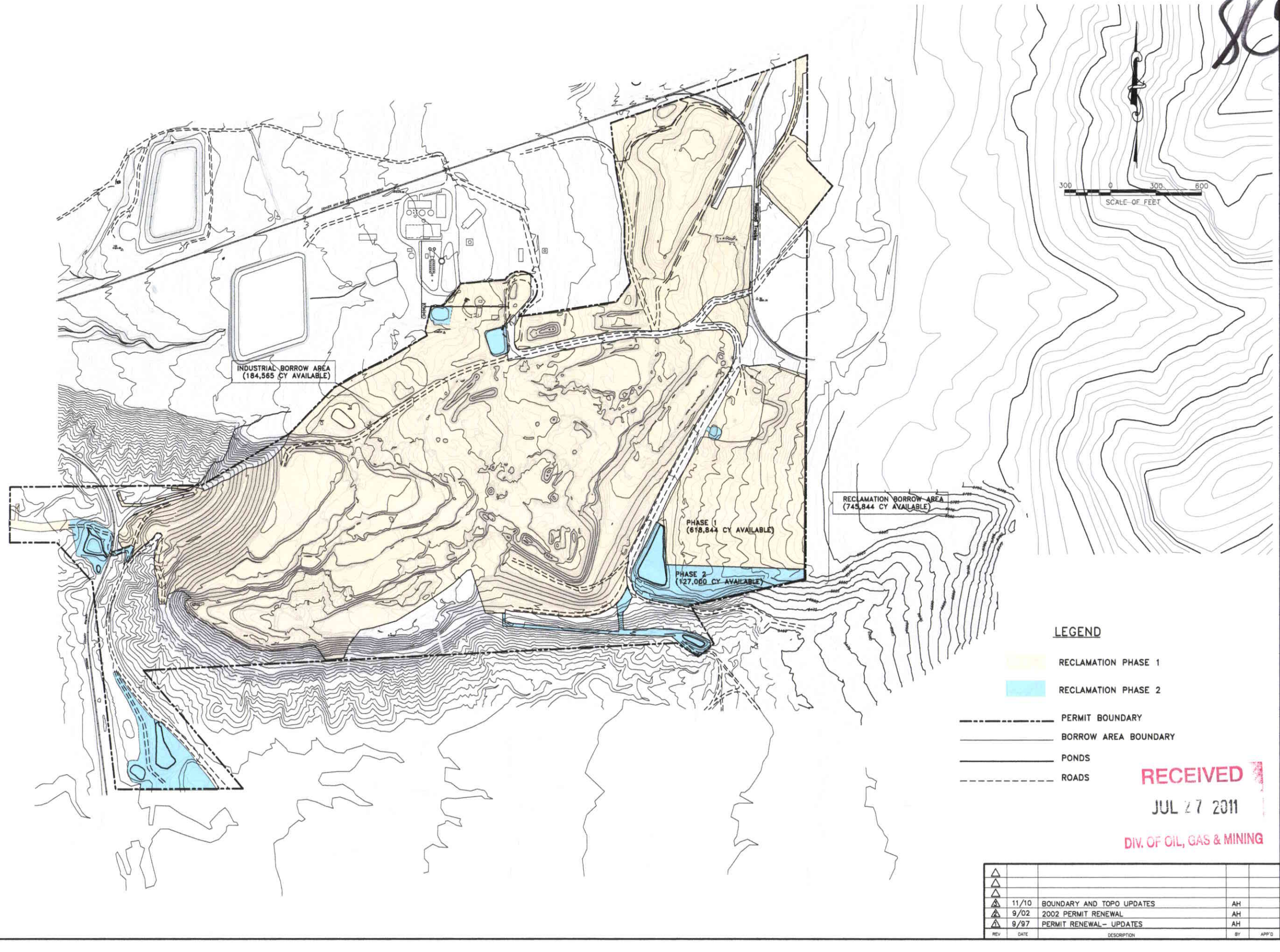
TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

SUNNYSIDE COGENERATION ASSOCIATES
BASELINE WATER MONITORING POINTS
SUNNYSIDE, CARBON COUNTY, UTAH

SCALE: 1" =2000'

SHEET NO. 7-2

PLOTTED DATE: Thursday, 03 February 2011 - 12:20pm



RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

REV	DATE	DESCRIPTION	BY	APP'D
5				
4				
3				
2	11/10	BOUNDARY AND TOPO UPDATES	AH	
1	9/02	2002 PERMIT RENEWAL	AH	
0	9/97	PERMIT RENEWAL- UPDATES	AH	

DESIGNED AH
DRAWN AH
CHECKED SSC
SHEET

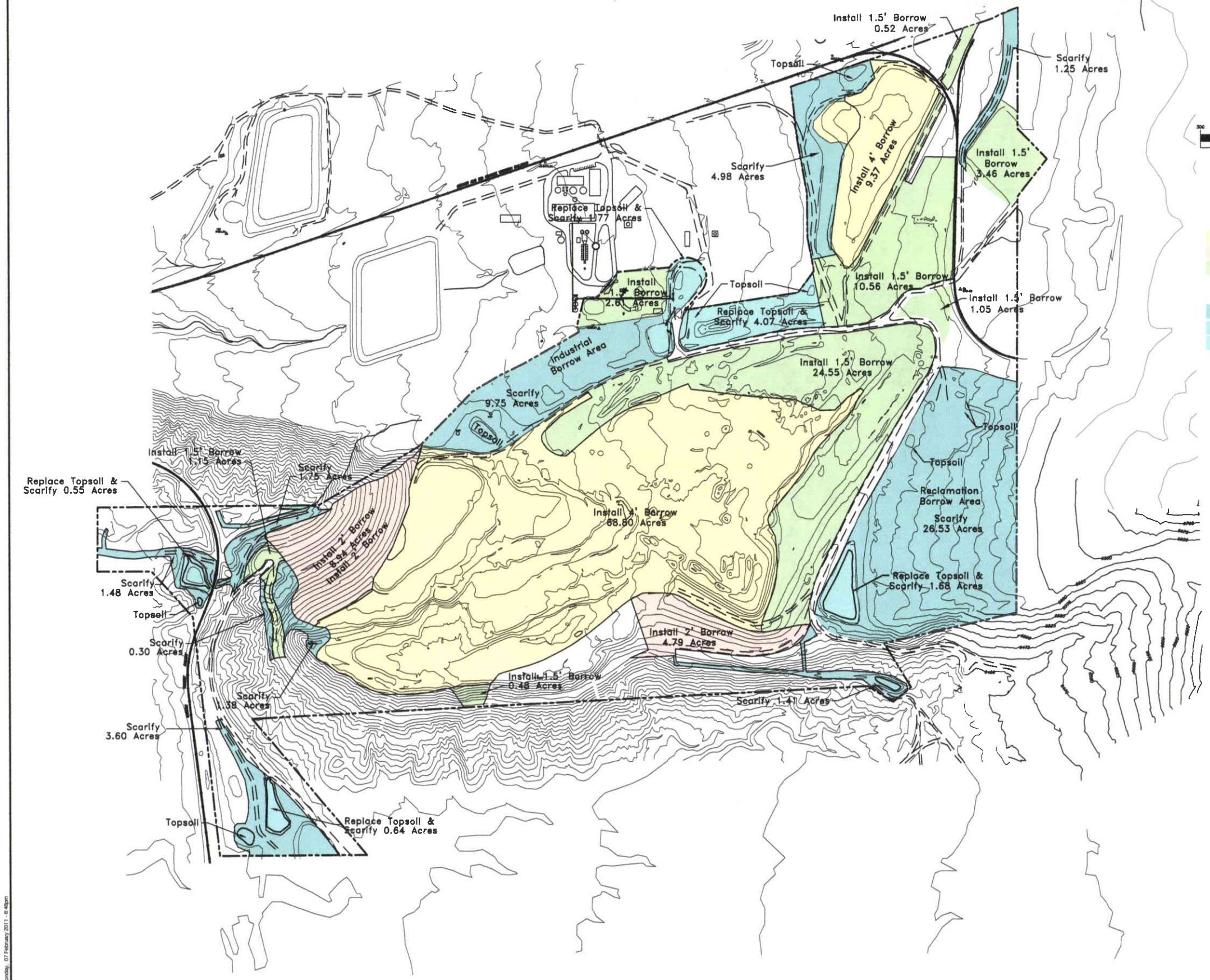
TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

Sunnyside Cogeneration Associates
PERMIT TERM RECLAMATION PLAN
PHASING PLAN

DATE 7-11-94
SCALE 1" = 300'
PROJECT NO. -

8-1

PLOTTED DATE: Thursday, 03 February 2011 - 4:06pm



NORTH

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

BORROW MATERIAL QUANTITIES

4' Borrow Cap X 78.17 Acres	=	504,457 CY
2' Borrow Cap X 13.73 Acres	=	44,302 CY
1.5' Borrow Cap X 44.39 Acres	=	107,423 CY
Total Borrow	=	656,182 CY

Scarify Soil Prior To Seeding	=	51.0 AC
Regrade, Scarify & Replace Topsoil	=	8.7 AC
Topsoil	=	7,928 CY

Notes:

1. At the time of final reclamation four feet of borrow material will be placed over areas that are occupied by unsuitable plant growth medium, as determined by testing. This includes slurry ponds and cells, and the upper refuse pile.
2. At the time of final reclamation two feet of borrow material will be placed over areas on the coarse refuse pile which have previously been covered with two feet of borrow material.
3. At the time of final reclamation up to eighteen inches of borrow material will be placed over areas which have some refuse on the surface only. These areas will have up to eighteen inches of refuse material, as determined by testing, scraped from the surface before being capped. The depth of material removed or added will be based on testing at the time of Reclamation. This scraped material will be used as fill for the slurry ponds and cells before they are capped with borrow material.
4. At the time of final reclamation, areas which have no refuse will be scarified to assist revegetation.
5. At the time of final reclamation, areas which have had topsoil removed and stockpiled, will have the topsoil redistributed. These areas will be scarified to reduce potential slippage of the redistributed material and to assist revegetation.
6. Some areas may be regraded as necessary to meet the post-mining land use prior to placement of borrow material, replacement of topsoil, or scarification of existing soil.
7. Minimal grading will be utilized to redistribute the dumped borrow materials sufficient to cover the reclaimed sites. The borrow materials will be spread unevenly to create small depressions which will retain moisture, minimize erosion, create and enhance wildlife habitat, and assist revegetation.

REV	DATE	DESCRIPTION	BY	APP'D
6	11/10	BOUNDARY AND TOPO UPDATES	AH	
5	10/02	2002 PERMIT RENEWAL	AH	
4	9/97	PERMIT RENEWAL-UPDATES	AH	
3	10/95	RECLAMATION AREAS	AH	
2	7/94	ADDED COAL PILE AREA	LK	
1				

9-11-94 | SCALE | PROJECT NO. -

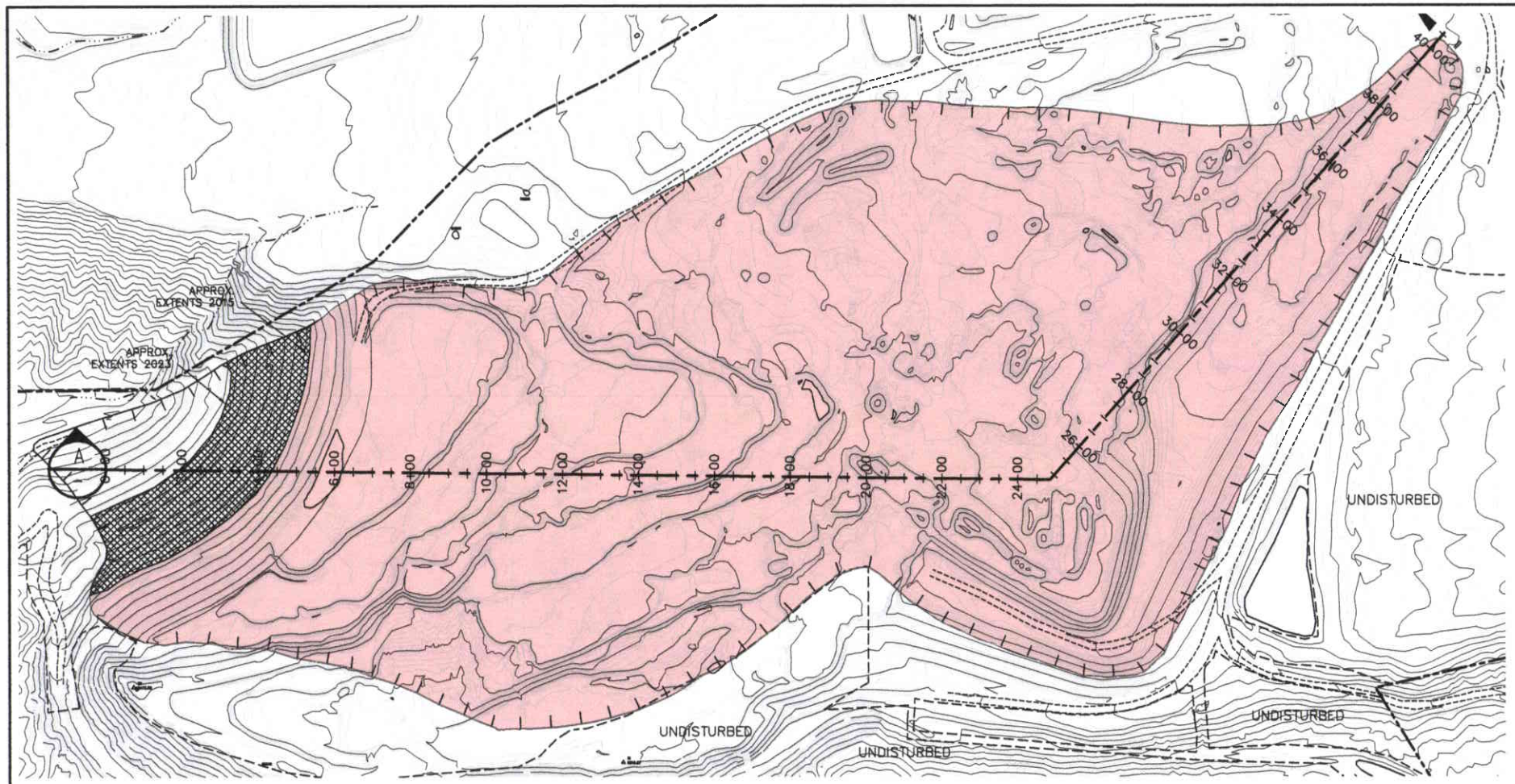
Sunnyside Cogeneration Associates
PERMIT TERM RECLAMATION PLAN
BORROW MATERIAL PLAN

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AH | DRAWN AH | CHECKED SSC

SHEET 8-4

PLOTTED DATE: Monday, 07 February 2011, 8:48pm



GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)

PLAN VIEW SCALE: 1" = 200'

CROSS-SECTION
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 60'

LEGEND

EXTENTS OF COAL REFUSE PILE

APPROX. MINE EXTENTS-YEARS 2010-2015

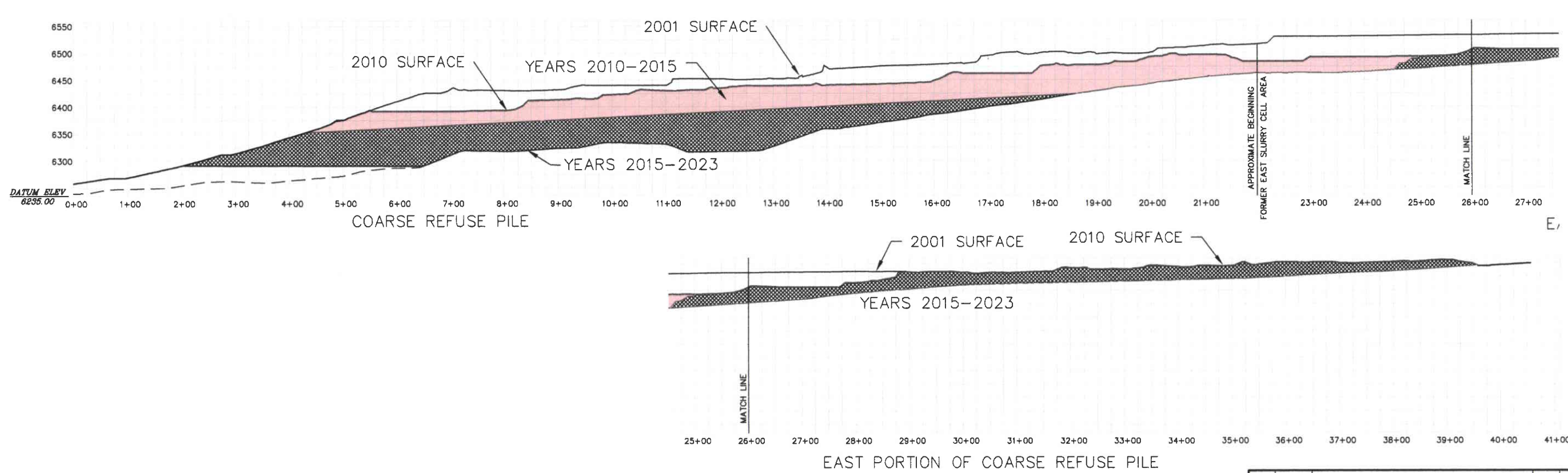
EXTENTS OF DISTURBED AREA

APPROX. MINE EXTENTS-YEARS 2015-2023

NOTE:

1. CROSS-SECTIONS AND DELINEATIONS OF ANNUAL SEQUENCE OF MINING OPERATIONS ARE PROJECTIONS ONLY. VARIATIONS MAY OCCUR AS DIFFERENT QUALITIES OF REFUSE ARE ENCOUNTERED. THIS IS NEEDED TO PROVIDE THE PROPER BLENDING OF WASTE MATERIALS TO MEET THE NEEDS OF THE COGENERATION PLANT.
2. MINING AND EXCAVATION ACTIVITIES SHOULD BE CONCENTRATED WITHIN THE SHADED AREAS. THESE ACTIVITIES WILL ALSO OCCUR IN OTHER AREAS OF THE REFUSE PILE, STORAGE AREAS AND WITHIN THE EXISTING DISTURBED AREA.
3. MINING ACTIVITY WILL MAINTAIN SAFE SLOPES. AT THE COMPLETION OF EXCAVATION ACTIVITIES IN AN AREA THE SIDE SLOPES WILL NOT BE STEEPER THAN THE ANGLE OF REPOSE.

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING



REV	DATE	DESCRIPTION	BY	APP'D
5				
4				
3				
2	11/10	BOUNDARY AND TOPO UPDATES	AH	
1	9/02	2002 PERMIT RENEWAL	AH	
0	9/97	PERMIT RENEWAL-UPDATES	AH	

09-1994 | SCALE 1" = 200' | PROJECT NO. -

Sunnyside Cogeneration Associates
MINE - SEQUENCING
YEARS 2010-2023

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AH | DRAWN AH | CHECKED SSC

SHEET 9-4

PLOTTED DATE: Thursday, 03 February 2011 - 7:46pm

300 0 300 600
SCALE OF FEET

LEGEND

- PERMANENT MINING AREA
- EXTENTS OF COAL REFUSE PILE
- EXTENTS OF DISTURBED AREA
- PERMIT BOUNDARY
- FUTURE DISTURBED AREA

NOTE:

MINING WILL OCCUR IN THE AREAS DELINEATED ON THE MAP THROUGHOUT THE LIFE OF THE MINE.

MINING ACTIVITIES WILL ALSO OCCUR IN OTHER AREAS WITHIN THE DISTURBED AREA BOUNDARY AS GENERALLY OUTLINED IN PLATE 9-4.

REV	DATE	DESCRIPTION	BY	APP'D
6				
5				
4	11/10	BOUNDARY AND TOPO UPDATES	AH	
3	9/02	2002 PERMIT RENEWAL	AH	
2	9/97	PERMIT RENEWAL-UPDATES	AH	
1	8/95	IDENTIFY FUT/DIST AREA	ND	

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

09/94 | SCALE 1" = 300' | PROJECT NO. -

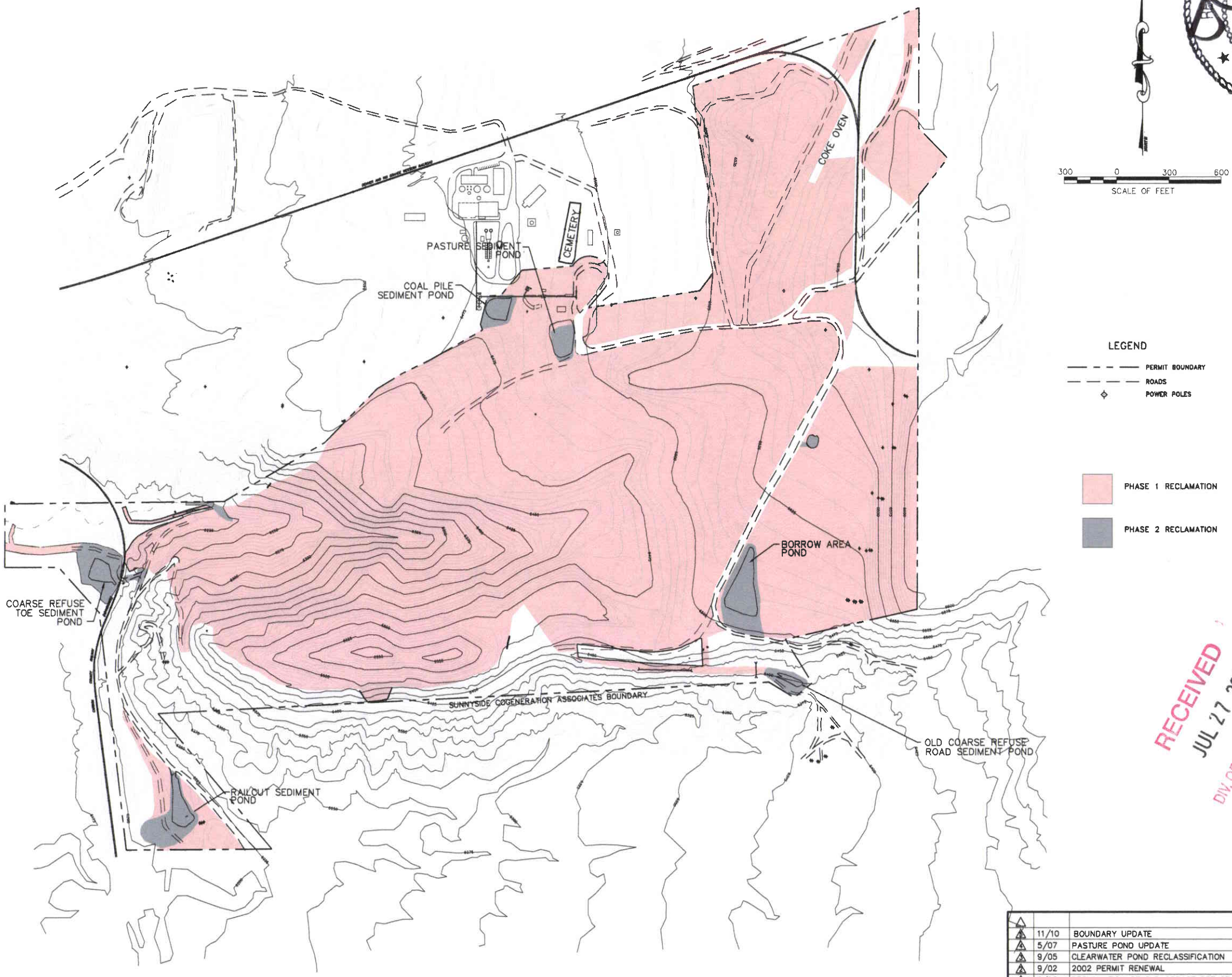
Sunnyside Cogeneration Associates
AREAS OF PERMANENT MINING ACTIVITY AND STORAGE AREAS

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AH | DRAWN AH | CHECKED SSC

SHEET 9-7

PLOTTED DATE: Thursday, 03 February 2011 - 5:30pm



REGISTERED PROFESSIONAL ENGINEER
5427
E. SCOTT CARLSON
STATE OF UTAH

RECEIVED
JUL 27 2011
DIV. OF OIL, GAS & MINING

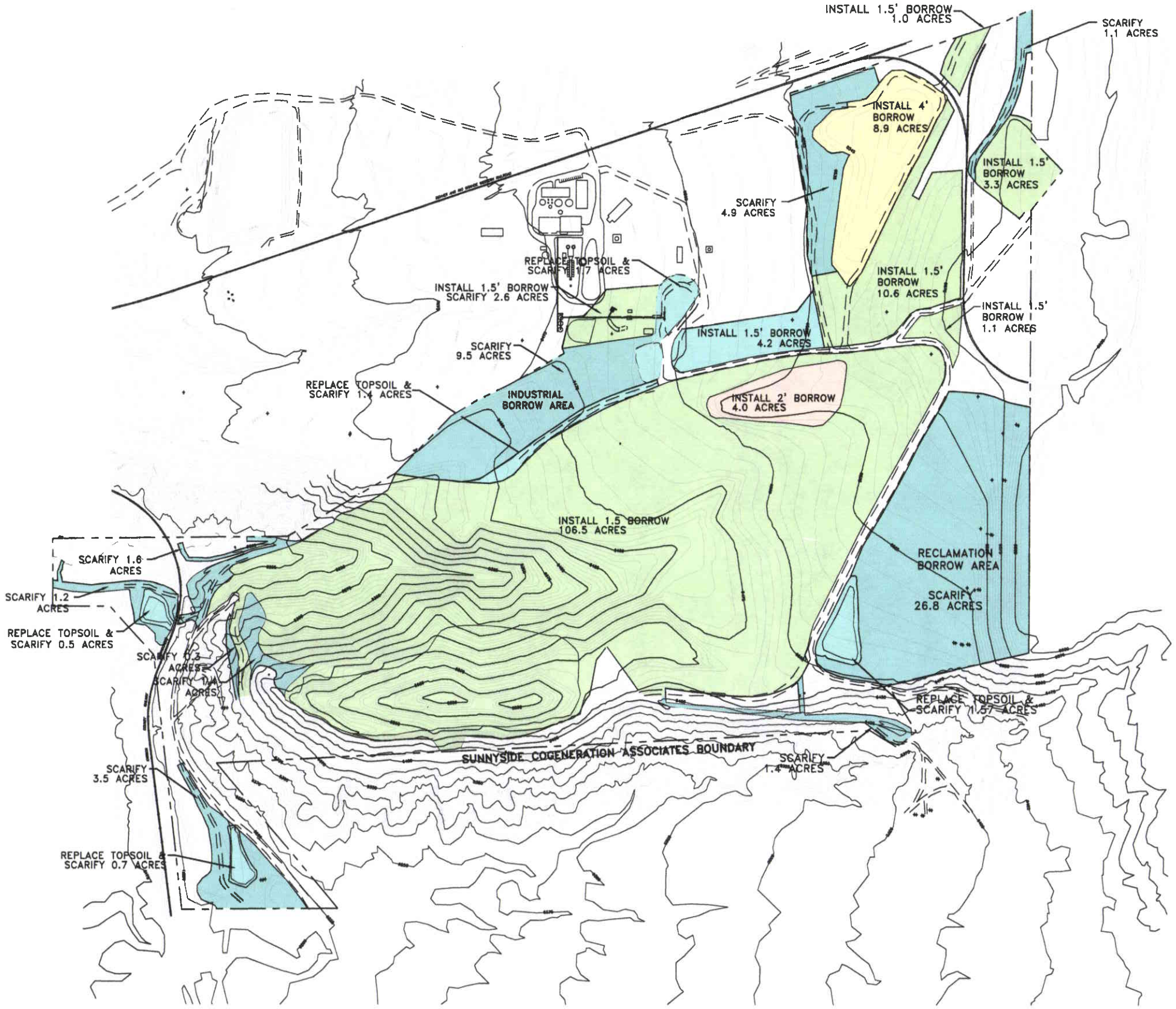
DATE 01-10-96
SCALE 1" = 300'
PROJECT NO. -

Sunnyside Cogeneration Associates
FINAL RECLAMATION
GRADING PLAN

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AEB
DRAWN AH
CHECKED AEB
SHEET 10-4 OF

REV	DATE	DESCRIPTION	BY	APP'D
6	11/10	BOUNDARY UPDATE	AH	
5	5/07	PASTURE POND UPDATE	AH	
4	9/05	CLEARWATER POND RECLASSIFICATION	AH	
3	9/02	2002 PERMIT RENEWAL	AH	
2	8/95	RECLAMATION OF OLD CORASE REFUSE ROAD	ND	
1				



300 0 300 600
SCALE OF FEET

LEGEND
- PERMIT BOUNDARY
- EXCESS SPOIL DISPOSAL AREA
- ROADS
- POWER POLES

BORROW MATERIAL QUANTITIES

4' BORROW CAP X 8.9 ACRES	=	57,434 CY
2' BORROW CAP X 4.0 ACRES	=	12,906 CY
1.5' BORROW CAP X 125.4 ACRES	=	303,468 CY
TOTAL BORROW	=	373,808 CY
SCARIFY SOIL PRIOR TO SEEDING	=	51.7 AC
REGRADE,SCARIFY & REPLACE TOPSOIL	=	10.1 AC
TOTAL AVAILABLE TOPSOIL	=	7,928 CY

NOTES:

1. ANY AREAS THAT REMAIN COVERED WITH COARSE REFUSE WILL BE COVERED WITH FOUR (4) FEET OF BORROW MATERIAL AND THE AREA REVEGETATED.
2. AT THE TIME OF FINAL RECLAMATION, THE OUTER SURFACE OF THE EXCESS SPOIL DISPOSAL AREA (SHOWN IN PLATE 9-1B) WILL HAVE AT LEAST EIGHTEEN (18) INCHES OF SUITABLE PLANT GROWTH MATERIAL AND BE REVEGETATED. ATTEMPTS WILL BE MADE TO PLACE SPOIL THAT IS SUITABLE PLANT GROWTH MATERIAL ON THE FINAL SURFACE. IF SUITABLE SPOIL IS NOT AVAILABLE THEN BORROW MATERIAL WILL BE USED TO OBTAIN THE NEEDED DEPTH.
3. AT THE TIME OF FINAL RECLAMATION, AREAS WHICH HAVE HAD TOPSOIL REMOVED AND STOCKPILED, WILL HAVE THE TOPSOIL REDISTRIBUTED. THESE AREAS WILL BE SCARIFIED TO REDUCE POTENTIAL SLIPPAGE OF THE REDISTRIBUTED MATERIAL AND TO ASSIST REVEGETATION.
4. OTHER AREAS AS SHOWN WILL BE COVERED WITH UP TO EIGHTEEN (18) INCHES OF BORROW MATERIAL OR BE CLEANED AND SCARIFIED. SUFFICIENT SAMPLES SHALL BE TAKEN AND ANALYZED OF THE EXISTING SOIL TYPES TO DEMONSTRATE THAT THE COMBINED DEPTH OF BORROW MATERIAL AND EXISTING MATERIAL IS SUFFICIENT TO PROVIDE SUITABLE GROWTH MEDIUM COMPARABLE TO THE NATURAL CONDITIONS WHICH EXISTED PRIOR TO DISTURBANCE.
5. THE BORROW MATERIAL AND TOPSOIL IS TO BE DISTRIBUTED BY END-DUMPING. MINIMAL GRADING WILL BE UTILIZED TO REDISTRIBUTE THE DUMPED MATERIALS TO SUFFICIENTLY COVER THE RECLAIMED SITE. THE BORROW MATERIALS WILL BE SPREAD UNEVENLY TO CREATE SMALL DEPRESSIONS WHICH WILL RETAIN MOISTURE, MINIMIZE EROSION, CREATE AND ENHANCE WILDLIFE HABITAT, AND ASSIST REVEGATATION
6. THE RECLAMATION BORROW AREAS USED DURING THIS FINAL RECLAMATION WILL BE CONTOURED DURING BORROW MATERIAL REMOVAL, LEFT AS A SMALL DEPRESSION AND REVEGETATED AFTER REQUIRED BORROW MATERIAL HAS BEEN REMOVED. A BERM OR DIVERSION MAY BE USED TO DIRECT RUNOFF FROM THE UNDISTURBED AREA AROUND THE DISTURBED BORROW AREA.

REV	DATE	DESCRIPTION	BY	APP'D
4	11/10	BOUNDARY UPDATE	AH	
3	9/02	2002 PERMIT RENEWAL	AH	
2				
1				
0				

1-10-95 | SCALE 1" = 300' | PROJECT NO. -

Sunnyside Cogeneration Associates
FINAL RECLAMATION PLAN
BORROW MATERIAL PLAN

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3511, (801) 439-0700 FAX

DESIGNED AEB | DRAWN AH | CHECKED AEB

SHEET 10-6

PLOTTED DATE: Monday, 07 February 2011 - 5:26pm